This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

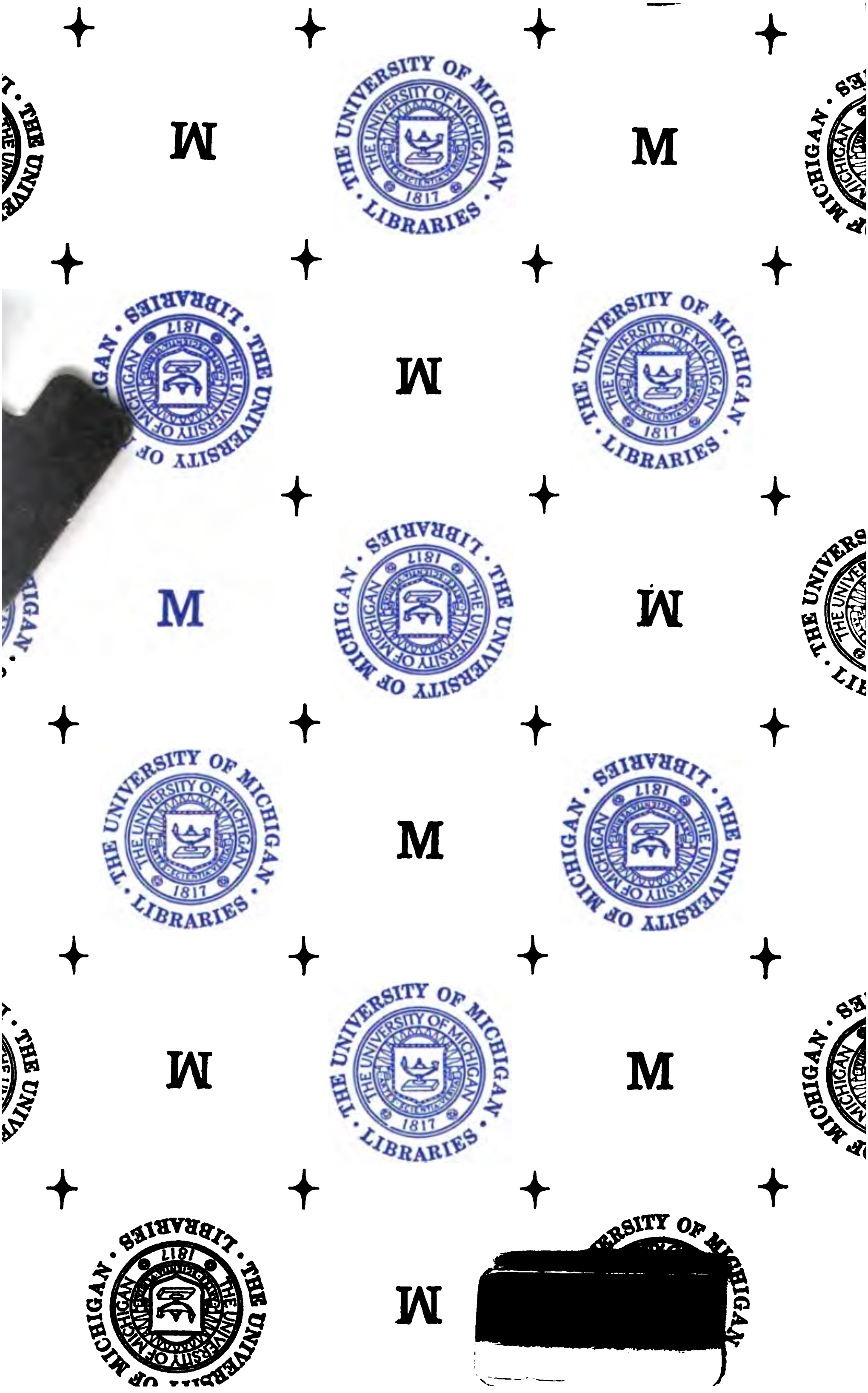
+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`



THE UNIVERSITY OF MICHIGAN LIBRARIES 1817

THE UNIVERSITY OF MICHIGAN LIBRARIES 1817

REPORT

OF THE

BOARD OF COMMISSIONERS O
AGRICULTURE AND FORESTR

OF THE

TERRITORY OF HAWAII

FOR THE

BIENNIAL PERIOD ENDING DECEMBER 31st, 1

HONOLULU, T. H.
HONOLULU STAR-BULLETIN, LTD.
1913

OFFICERS AND STAFF
OF THE
Board of Commissioners of Agriculture and Forestry
1913

COMMISSIONERS.

Walter M. Giffard, *President and Executive Officer.*

J. M. Dowsett	Arthur H. Rice
H. M. von Holt	Albert Waterhouse

DIVISION OF FORESTRY.

Ralph S. Hosmer, *Superintendent of Forestry and Chief Fire Warden.*

David Haughs, *Forest Nurseryman.*

Bro. Matthias Newell, *in charge of Sub-Nursery at Hilo, Hawaii.*

Walter D. McBryde, *in charge of Sub-Nursery at Homestead, Kauai.*

Joseph F. Rock, *Consulting Botanist.*

DIVISION OF ENTOMOLOGY.

Edward M. Ehrhorn, *Superintendent of Entomology and Chief Plant Inspector.*

D. B. Kuhns, *Assistant Plant Inspector.*

Bro. M. Newell, *Plant Inspector, Hilo, Hawaii.*

E. E. Madden,	*Honorary Plant Inspector at*	*Mahukona, Hawaii.*
W. O. Aiken,		*Kahului, Maui.*
W. D. McBryde,		*Koloa, Kauai.*
Dr. W. B. Deas,		*Hana, Maui.*
Capt. C. F. Turner,		*Kaanapali, Maui.*
G. C. Munro,		*Manele, Lanai.*

DIVISION OF ANIMAL INDUSTRY.

Victor A. Nörgaard, *Superintendent of Animal Industry and Territorial Veterinarian.*

L. N. Case, *Assistant Territorial Veterinarian.*

H. B. Elliot, *Deputy Territorial Veterinarian for Hawaii.*

J. C. Fitzgerald, *Deputy Territorial Veterinarian for Maui.*

A. R. Glaisyer, *Deputy Territorial Veterinarian for Kauai.*

Clerical Staff.

Mrs. A. Oram, *Stenographer and Librarian.*

Mrs. C. L. Seybolt, *Clerk.*

Hawaiian Forester and Agriculturist.

Daniel Logan, *Editor.*

Plate 1. **A Hawaiian Protection Forest.**

REPORT

OF THE

BOARD OF COMMISSIONERS OF AGRICULTURE AND FORESTRY

OF THE

TERRITORY OF HAWAII

FOR THE

BIENNIAL PERIOD ENDING DECEMBER 31st, 1912

HONOLULU, T. H.
HONOLULU STAR-BULLETIN, LTD.
1913

CONTENTS.

REPORT OF THE COMMISSIONERS.

PAGE.
Introduction 1
- Personnel 1
- Meetings 1

Publications.
- Division of Forestry 2
- Division of Entomology 2
- Botany 2
- Division of Animal Industry 2
- Monthly Publication 2

Division of Forestry.
- Forest Reserves 3
- Protection of native forests 3
- Forest planting 4
- Plant distribution 5
- Experimental forest planting 5
- Forest fires 6
- Staff 6
- Recommendations 6

Division of Entomology.
- Inspection of freight 8
- Equipment for fumigation and inspection work 8
- Inter-island inspection 9
- Fruit fly control 10
- Horn fly parasite work 12
- Field inspection of agricultural areas 12
- Recommendations 13

Division of Animal Industry.
- Regulations 14
- Live stock conditions in general 15
- Importations of live stock 15
- Diseases of live stock 16
- Bovine Tuberculosis control work 17
- Inspection at San Francisco 18
- Quarantine Stations 18
- Recommendations 19

Pure Seed law 20

Conclusion 20

Allotments and Expenditures.
- Allotments 21
- Statement of Expenditures 22
- Special appropriations 25

APPENDIX TO REPORT OF THE COMMISSIONERS.

Letter of Transmittal 28

Some Observations on Hawaiian Forests and Forest Cover.
- The Nature and Peculiarities of the Wet Forests of Hawaii and the Cause of their Deterioration and Decline 29
- The Intermediate Forest Areas and their Relation to the Water Sheds 31
- The Oahu Water Sheds and their Relation to the Water Supply of the Honolulu and Ewa Basins 33

PAGE.
The Need for Hydrographic Investigations in Conjunction with Systematic Forest Work in Hawaii 36
Indigenous Forests in Hawaii not essentially needed for Conservation Purposes 39
Forests Intended for Purely Economic Uses 41
Forest Plantings on Areas Above the Wet Forest Zone on Certain Islands 43
List of Tree-seeds adaptable for planting in Hawaiian forests. 44

DIVISION OF FORESTRY.

Report of the Superintendent of Forestry.

Introduction 49
  The reason for practicing forestry in Hawaii 49
  Summary 51
  Staff 51
  Appropriations 52
Forest Reserves 52
  New reserves 54
  Tables with forest reserve statistics:
    Forest Reserves arranged in chronological order... 56
    Forest Reserves arranged by islands and counties... 58
  Proposed forest reserves 60
  Fencing forest reserve boundaries 60
  Kahoolawe 61
Forest Planting 62
  Eucalyptus bulletin 63
  Plant Distribution 64
  Sub-nurseries 65
    Table of trees distributed 65
  Tree planting by corporations 66
    Table, number of trees planted 1911 and 1912........ 68
  Spreading the Algaroba 70
  Tree Planting on Government land 70
    Pupukea, Oahu 70
    Waimea, Hawaii 71
    Fungus disease of Eucalyptus 72
  Plant Introduction Work 73
    Experimental planting 73
    A new introduction 74
    Papapaholahola Station, Kauai 74
  Forest planting in Koolau, Maui 75
  Federal experimental tree planting 75
    Nuuanu Valley 75
    Experimental plots on the high mountains 76
Miscellaneous forest work 77
  Reports and publications 77
  Botanical Survey 78
Forest Fires 79
Summary of Recommendations 80

Report of the Forest Nurseryman.

  Nursery 82
    Collection and Exchange of seeds 82
    Exchange of seed 82
    Seed received through exchange 83
  Plant distribution 84
    Propagating trees for plantation companies 86
  Realizations 86

GENERAL BOOKBINDING CO.
52AA 013 C
75 2 1
QUALITY CONTROL MARK
4261

PAGE.
Other work 87
Nursery grounds 87
Advice and assistance 87
Congressional seed and year books 88
Experimenal Garden, Makiki 88
Basket Willow 88
Tantalus Forest 89
List of District Fire Wardens 90
List of District Foresters 94
Report of the Consulting Botanist.
Exploration of the windward side of Haleakala, Maui 95
Transfer of the Herbarium 97
Plant protection 97
Discovery of a Native Hawaiian Rubber-producing tree 98
Collection of seed for exchange purposes 98

DIVISION OF ENTOMOLOGY.

Report of Superintendent of Entomology.
Staff 101
Work Performed 102
Tables: Inspection work.
Monthly Inspection, Honolulu, 1911 104
Monthly Inspection, Honolulu, 1912 105
Monthly Inspection, Hilo, 1911 106
Monthly Inspection, Hilo, 1912 107
Fruits and Vegetables, Honolulu, 1911 108
Fruits and Vegetables, Honolulu, 1912 110
Fruits and Vegetables, Oriental Cargo, 1911 112
Fruits and Vegetables, Oriental Cargo, 1912 114
Fruits and Vegetables, Oriental Cargo, Hilo, 1911 116
Fruits and Vegetables, Oriental Cargo, Hilo, 1912 118
Injurious Insects and Diseases Intercepted 122
Inter-island Inspection 126
Table: Inter-island inspection 128
Rule IX—Prevention of distribution of insect pests 130
Rule XI—Prevention of distribution of insect pests 130
Fruit Fly Control 131
List of fruits and vegetables attacked 133
Rule XVII: Control of the Mediterranean Fruit Fly 136
General Clean Culture 137
Cotton Boll Worm 139
Rule XII: Control of insect and other vegetable pests .. 140
Banana disease 141
Rule VIII: Concerning the importation of bananas 141
Seed Inspection 142
Pure Seed Law 142
Horn Fly parasite 145
Record of material sent by Prof. Koebele, 1911 145
Record of material sent by Prof. Koebele, 1912 147
Additional notes 148
Thimbleberry 149
Rule XIII: Control of Thimbleberry 149
Federal Horticultural Board 150
Recommendations 151

DIVISION OF ANIMAL INDUSTRY.

PAGE.

- Letter of submittal 153
  - Bovine Tuberculosis 153
  - Glanders 157
  - Rabies 158
- Report of the Territorial Veterinarian.
  - The Live Stock Industry of the Territory 160
  - Importation of Live Stock 163
    - Horses 163
    - Mules 164
    - Cattle 164
    - Sheep 164
    - Swine 165
    - Poultry 165
  - The Hilo and Kahului Quarantine Stations 165
  - Meeting of the American Veterinary Medical Association at Toronto, Canada 166
  - Diseases of Live Stock in general 168
    - Glanders 168
    - Bovine Tuberculosis 169
    - Cerebro-spinal meningitis 171
    - Sheep disease on Lanai 171
  - The Control and Eradication of Bovine Tuberculosis.......... 172
    - Human and Bovine Tuberculosis 172
      - Ninth International Tuberculosis Congress 172
      - Tenth International Tuberculosis Congress 173
      - Congress of the Royal Sanitary Institute of Great Britain 174
      - Pasteurization 176
    - Tuberculin testing of the dairy herds, Honolulu.......... 177
  - The intradermal tuberculin test 179
    - Character of reaction 180
    - Disinfection of premises 182
    - Conclusions 183
  - The Milk Supply of Honolulu 183
    - Bacteriological examination of the milk supply 184
    - Milk purifying by electricity 185
  - Glanders in the Territory of Hawaii 186
    - Glanders at Schofield Barracks 187
    - Glanders in Waipio Valley 189
  - The intradermal mallein test 199
    - Practical application of the method 203
    - Conclusions 204
  - Rabies in Dogs and Hydrophobia in Man 205
    - Prevalence of the disease 205
      - Prevalence of Rabies in the U. S. 206
      - Rabies in California 207
      - Nature, Cause and Transmission of Rabies.......... 207
      - Symptoms of Rabies 208
      - Danger of introduction into the Territory 209
      - Period of incubation in Rabies 209
      - Rabies Regulation 210
      - Warning to Tourists 210
    - Rule concerning quarantine of dogs for Rabies.......... 211
    - The Dog Quarantine Station 212
    - The Eradication of Mangy Dogs in Honolulu 213
  - A peculiar disease among the sheep on the Island of Lanai.... 214
      - Condition of Native Sheep 215

PAGE.

Symptoms 215
Pathology 216
Bacteriology 216
Classification 216
Prevention 216
Eye Worm in Chickens 218
Characterization 218
History and Distribution 218
Etiology 219
Treatment 220
Prophylaxis or prevention 220

Report of the Deputy Territorial Veterinarian for the Hilo District.

General Observations 221
Importation of live stock 221
Quarantine facilities at the Port of Hilo 222
Contagious and Infectious diseases 223
Glanders 223
Epizootic cerebro-spinal meningitis 224
Endemic catarrhal fever 226
Tuberculosis 227
Parasitic diseases 227
Liver fluke in cattle 227
Heart worm in dogs 228
Extract from Report of the Hilo Board of Trade........ 228
Public Health and Sanitation 228

Report of the Deputy Territorial Veterinarian for the Maui District.

Stock Breeding 230
Importations 231
Diseases of live stock 234
Tetanus 234
Cerebro-spinal meningitis 234
Acute 236
Sub-acute 236
Mild 237
Post Mortem Examination 237
Immunity 238
Susceptibility 238
Treatment 238
Stable management 239
Glanders and Epizootic Lymphangitis 239
Tuberculosis 240
Quarantine Station 243

Report of the Deputy Territorial Veterinarian for the Kauai District.

Introduction 244
Diseases of live stock 245
Cerebro spinal-meningitis 245
Tetanus 245
Intestinal parasites 246
Heart worm 246
Tuberculosis 247
Practice in general 248
Live stock breeding 248

ILLUSTRATIONS.

Plate 1. A Hawaiian Protection Forest ....Frontispiece
Facing Page
" 2. Ie-ie Vine on Ohia Lehua Tree 32
" 3. The Upper Transition Zone 32
" 4. Where the forest gives place to grazing land........ 40
" 5. Fern Undergrowth in the Hawaiian Forest.............. 40
" 6. An Irrigation Ditch in the Forest 49
" 7. Dense Forest on a Ridge in a Watershed 52
" 8. A Hawaiian Forest after fire and grazing 52
" 9. Remnants of the Past 52
" 10. The ultimate result of forest destruction. Kahoolawe.. 52
" 11. A Shipment of Seedlings for a Sugar Plantation Company 64
" 12. Papapaholahola Sub-Nursery and Experimental Planting Ground, Homestead, Kauai 72
" 13. Experimental Eucalyptus Plantation, Nuuanu Valley near Honolulu 72
" 14. Eucalyptus Robusta Windbreak, Nuuanu Valley Plantation 72
" 15. Experiment Garden in Makiki Valley 88
" 16. Potting Shed, Soil Sterilizer and Seedling Benches. Makiki Station 88
" 17. Willow Baskets Made from Plants Grown at Makiki Experiment Garden 88
" 18. The Koko or Akoko 96
" 19. Kokia Rockii Lewt. Kokia 96
" 20. Kokia Rockii Lewt 96
" 21. Dog Quarantine Station, Honolulu 153
" 22. Dog Quarantine Station, Honolulu 160
" 23. Pure Bred Registered Holstein Bulls 168
" 24. Kentucky Bred Jack 168
" 25. Two Kentucky Bred Jacks 168
" 26. Part of a Shipment of Pure Bred Registered Hereford Heifers 172
" 27. Two Heifers by Bonine Brae 8th 172
" 28. Dog Quarantine. The Lethal Chamber 212
" 29. Dog Quarantine. The Lethal Chamber 212
" 30. Sileo. Thoroughbred Stallion 232
" 31. Fig. 1. Bay Filly, by Sileo ex Divina 232
Fig. 2. Bay Colt, by Sileo ex Dorelike 232
" 32. Fig. 1. Delagoa. Bay Mare by Kingston ex Rhodesia.. 232
Fig. 2. Delagoa's Colt by Von Tromp 232
" 33. Fig. 1. Northwest, by Montana ex Nina M. 232
Fig. 2. Northwest's Filly by Bearcatcher 232
Plate 34. Fig. 1. Lady Toddington, by Imp. Toddington ex Merry Heart by Sir Modred 232
Fig. 2. Brown Filly, by Von Tromp ex Toddington.... 232
" 35. Fig. 1. Solum, head of the stud owned by W. H. Rice, Sr. 244
Fig. 2. Imported Jack. Owned by Lihue Plantation Co. 244
" 36. Draft Horses. Raised by W. H. Rice, Sr. of Kauai.... 244

BOARD OF AGRICULTURE AND FORESTRY.

Report of the Commissioners.

Honolulu, T. H. December 31, 1912.

Hon. Walter F. Frear,
Governor of Hawaii,
Honolulu, Hawaii.

Sir:—The Board of Commissioners of Agriculture and Forestry has the honor to present herewith its report for the biennial period ending December 31, 1912.

PERSONNEL.

During the past biennial period many changes have taken place in the personnel of the Board, viz: Mr. Chas. S. Judd was appointed President and Commissioner on July 25, 1911, vice Mr. Marston Campbell, resigned; Mr. W. M. Giffard appointed President and Commissioner January 21, 1912, vice Mr. Chas. S. Judd, resigned; Mr. Arthur H. Rice appointed Commissioner on September 3, 1912, vice Mr. D. P. R. Isenberg, resigned. Mr. H. M. von Holt was reappointed on August 31, 1911. Mr. Albert Waterhouse, January 3, 1911, and Mr. J. M. Dowsett, January 9, 1913.

MEETINGS.

During 1911 and 1912 the Board held 49 regular and special public meetings, and in addition thereto held three joint meetings with the Governor for public hearings on questions of Forest Reserves. The several Standing Committees of the Board have also held numerous meetings to consider such matters as had been submitted to them for investigation and recommendation.

PUBLICATIONS.

DIVISION OF FORESTRY.

Bulletin No. 1—"Eucalyptus Culture in Hawaii," by Louis Margolin.

Circular No. 2—"Instructions for Propagating Forest, Shade and Ornamental Trees," by David Haughs.

DIVISION OF ENTOMOLOGY.

Circular No. 3—"Mediterranean Fruit Fly (Ceratitis Capitata)," by E. M. Ehrhorn, Supt. of Entomology.

Rule VIII—Concerning the Importation of all Banana Fruit, Banana Shoots or Plants.

Rule IX—Concerning the prevention and Distribution of Insect Pests from Oahu to the Other Islands.

Rule XVII—Concerning the Control of the Mediterranean Fruit Fly and Other Insect and Vegetable Pests, Repealing Rules X, XI, XIV, XV and XVI of the Board of Agriculture and Forestry.

BOTANY.

Botanical Bulletin No. 1—"New and Noteworthy Hawaiian Plants," by Dr. L. Radlkoffer and J. F. Rock. September, 1911.

ANIMAL INDUSTRY.

Rule VI—Concerning the Quarantine of Dogs for Rabies. January 27, 1912.

MONTHLY PUBLICATION.

Vol. VIII & IX—"Hawaiian Forester and Agriculturist."

DIVISION OF FORESTRY.

During the past biennial period the activities of the Division of Forestry have followed the general program that has now been in force in Hawaii for ten years. The creation of forest reserves on the important watersheds, as the first step toward the protection of the native forest; the furthering of measures to make that protection effective on the ground, through fencing and the eradication of wild stock; the extension of the native forest cover, naturally and by artificial planting; the encouragement of tree planting in general, by the Territorial Government, by corporations and by individuals; and, to some extent, the experimental planting of trees of economic importance new to the islands; these have been the chief lines of work of the Division of Forestry.

FOREST RESERVES.

The native forest in Hawaii is primarily of importance because it is the best cover obtainable for the catchment basins of the streams needed for irrigation. Its chief product is water, not wood. To make it serve its purpose most fully it needs to be managed strictly as a protection forest, from which men and animals are alike excluded. The forest reserve system is a means toward this end. Up to the close of 1912, twenty-seven forest reserves had been set apart by proclamation of the Governor of the Territory. The forest reserves now have a total area of 683,101 acres, of which 454,810 acres, or 67 per cent. is land belonging to the Territory. During the past two years four new reserves were added to the system, and three existing reserves somewhat enlarged. The resulting increase in area was 108,205 acres, 68,101 acres of which was government land.

PROTECTION OF NATIVE FORESTS.

The essential need now in forestry in Hawaii, the one that transcends all others, is that the forests on the watersheds be better protected. The fencing of boundaries that are not in themselves natural barriers, comes first; then the eradication of wild cattle and goats. It cannot too strongly be insisted on that such protection must be given, and that without delay, if the sources of water throughout the Territory are to be kept at their best. The constantly increasing demands on all the streams and, as well, upon the artesian sources of supply, which also of course are fed from the precipitation on the mountain slopes, render it absolutely essential that no stone be left unturned to safeguard and permanently to maintain the protective cover of the forest. Later, the extension of the native forest where the cover is broken or open is to be encouraged, but for the present the holding intact of what we now have is the dominant requirement.

To do these things of course requires money, and the initial expenditures must necessarily be considerable. But there is open a perfectly definite and practical way of getting money for these needs—the use for forest work of a part, at any rate, of the money now received by the Government from the sale of water in certain of the forest reserves.

At present this money is covered into the Territorial Treasury as a general realization, through the Land Office. That it, or a part of it, should be used to establish a revolving fund for fencing, protecting and extending the forest cover on the areas that yield water for irrigation, either directly through streams or indirectly through artesion wells, is certainly a logical demand.

By the reinvestment in the forest of money derived from the waters coming from the forest the whole circle is strengthened. The forest protects the water heads. Let the water help make the forest permanent, for the better cared for the forests, the more water will be available.

Under the forest law (Chapter 28, Section 385, Revised Laws of Hawaii), the Board of Agriculture and Forestry has the right to set apart as a special fund for forest work all revenues derived from the sale of forest products in forest reserves. The contention of the Board is that in our Hawaiian forest reserves water is essentially a forest product, and that money received from its sale should accrue to the special forest fund.

Because of points that have been raised of technical, legal objection, it may be necessary slightly to change the wording of the law. If so, that should be done, for the need of better protection for our native water-bearing forest is a real and vital one, and this way of meeting it is a straight business proposition, too good not to appeal to this community.

In this same connection it would be well if arrangements could be made for more closely affiliating the stream measurement and other hydrographic work now being carried on in Hawaii by the Water Resources Branch of the U. S. Geological Survey, with the work of the local Forest Service. In Hawaii water is essentially the important product of the forest. All the data gathered by the hydrographers have a direct bearing on forest protection. Conversely the influence of the forest determines in large measure how much water there is in the stream. For many reasons it would seem not inappropriate, therefore, to consider transfering the Hydrographic investigations from the Department of Public Works, where they now are, to the Board of Agriculture and Forestry, the relation of the Territorial Government to the conduct of the work in general to continue as at present. This is a matter that should be carefully considered by the Legislature.

FOREST PLANTING.

For the past two years a very considerable share of attention has been given by the Division of Forestry to tree planting, both that carried on directly by the Territory on government land and that done by corporations and individuals on their fee simple holdings. On the part of the Government blocks of forest were planted in the Pupukea Forest Reserve, Oahu, and on Kohala Mountain, above Waimea Village, Hawaii, respectively 35 and 50 acres. Also, under the requirements of Territorial Land Office leases, forest planting on government lands is in progress on a number of government tracts on Hawaii and Maui.

PLANT DISTRIBUTION.

Assistance to private owners is rendered by the Division of Forestry through advice as to how, where and what trees to plant to get desired results and through the furnishing at cost price of seed and seedlings of the species of trees most in demand. Both from the Government Nursery at Honolulu and from sub-nurseries at Hilo and at Homestead, Kauai, seedling trees are distributed, both gratis and at cost. The free distribution is mainly to individuals and for school-ground, street and roadside planting. From the Government Nursery at Honolulu considerable plant material has of late been furnished the various army posts on Oahu. In all, in 1911 there were sent out from the several Government Nurseries 620,739 plants. The figure for 1912 was 806,537. As in earlier years the free distribution of trees on Arbor Day was made a special feature of the work.

Interest in tree planting by corporations has materially strengthed during the last few years, and it is well that it has, for the need of a local supply of wood for fuel and other uses on the sugar plantations is one that continually increases in importance. But tree planting by the small owner is none the less to be encouraged. To further more of this latter class of work additional sub-nurseries should be established. Several are needed; the setting up of one or two more at once is almost imperative.

Another type of forest extension that should receive greater attention than it has in Hawaii is a systematic effort to extend the Algaroba forest. This work, the value of which must appeal to everyone, should be actively pushed both by the Government and by private interests.

In connection with tree planting, the Division of Forestry continues to supply advice and give out information regarding all sorts of forest and nursery work. In July, 1911, a bulletin was issued entitled "Eucalyptus Culture in Hawaii," being the result of an investigation of the planted stands of Eucalypts, carried on in 1910. In June, 1912, a revised edition of a circular of instructions as to tree planting was printed and distributed.

EXPERIMENTAL FOREST PLANTING.

The experimental planting of exotic trees of economic importance has, with the aid of the Federal Government, been continued during the past two years. A plantation of Eucalypts new to the Territory has been established in Nuuanu Valley where these species will be tried out.

The introduction of exotic trees into Hawaii is a line of investigation that ought to receive greater attention than has yet been given it. Species are needed—trees and shrubs—that will supplement the native flora and be suitable for planting where the cover of the wet forest needs to be extended, quite as much as trees of strictly commercial value, useful because of the wood and timber they can be made to yield. Only by actual trial can positive knowledge be got as to how a given species will succeed under local conditions. Introduction of new plants must be preceded by a careful study of their requirements, but after that it is necessary, too, to make the actual test on the ground. Provision should be made for extending the activities of the Division of Forestry in this particular.

FOREST FIRES.

Fortunately for the Territory, the record of forest fires for the past two years is almost negligible but there have been a number of brush and grass fires near the forest which had they not been promptly checked might have resulted in serious damage. Part of the credit for this belongs to the Forest Fire Service. The District Fire Wardens throughout the Territory have done not a little to change public opinion and build up a better understanding of the danger of damage from fire, and consequently of the need for greater care in the use of fire near the forest.

STAFF.

During the two years past the only change made in the staff of the Division of Forestry was the transfer in September, 1911, of Mr. Joseph F. Rock to the faculty of the College of Hawaii, whereby he became Honorary Consulting Botanist, in place of Botanical Assistant.

RECOMMENDATIONS.

In looking ahead emphasis should be placed on the few most pressing needs. These are: (1) the better protection of the native forests needed for watershed protection, essentially through fencing and the killing off of wild stock; (2) better provision for getting seedling trees and plant material into the hands of those who want to do forest planting, through the establishment of additional sub-nurseries; (3) the extension of experimental planting with particular reference to the introduction of plants that will supplement the native forest of the wet districts; (4) the actual planting of areas of government land in various parts of the Territory; and (5) the continuation and strengthening of the existing policies of the Division of Forestry regarding the protection of the forests from fire and the giving of advice and assistance to owners of forest land. Suitable provision for each of these lines of work should be made by the Legislature.

Up to now the activities of the Division of Forestry have been confined to laying the foundations of the forest reserve system, to rendering assistance to tree planters, and to carrying on an educational campaign as to the necessity for forestry in Hawaii. The work here recommended starts a new period. It carries the forest work of the Territory from the office into the field.

Heretofore the routine work of the Division of Forestry has been paid for out of regular allotments from the general appropriation. For the extensions now recommended additional funds are required. To secure sufficient money for forest fencing, the eradication of wild cattle and goats, and for repairing breaks in the forest cover through planting, we recommend the setting apart as a special fund of a portion of the revenue derived from water licenses in the forest reserves. Water is the important product of the Hawaiian forests. Money derived from its sale should go back into protecting and improving the condition of the forest. And as the hydrographic investigations now under way properly are a part of the same program, provision should be made for carrying them on as well under the same auspices. By turning back the water revenues for a time into the forest, the whole system of forests and waters can be established on a firm and permanent basis. In no other way can the protection of the native forests be as readily provided for. Unless the forests are protected, and that soon, so that the supply of water is permanently assured, the continuance of the prosperity of the Territory will be endangered.

The report of the Superintendent of Forestry covers in detail the matters here outlined; it is followed by a statement from the Forest Nurseryman and by a list of the District Fire Wardens.

A paper on "Some Observations on Hawaiian Forests and Forest Cover in their Relation to Water Supply," by W. M. Giffard, submitted to the Joint Committee on Forestry of the Hawaiian Sugar Planters' Association and the Board of Agriculture and Forestry also finds a place in this volume. Especial attention is directed to the forcible remarks therein, relative to the protection of our native forests and the conservation of water for agricultural purposes and city supply.

DIVISION OF ENTOMOLOGY.

The work of this Division has in the main continued as in the past, viz: Insect control by inspection of all fruits, vegetables and soils, plants and other vegetation imported into the Territory as freight, express or mail matter, or in the personal baggage of the traveling public.

INSPECTION OF FREIGHT, ETC.

Owing to a marked increase of shipping and in the quantity of importations of fruits, plants and other vegetation into the Territory during the past biennial period the work of the Inspector and his assistants has been at times very much taxed, particularly when several steamers have arrived on any one day.

At Honolulu and Hilo 991 vessels were boarded during the period, and plants or other vegetable matter was found on 556 of these. This shows an increase of 88 vessels boarded and of 72 vessels bearing vegetable matter over the previous biennial period. During 1911 and 1912 these officials inspected 204,059 and 280,930 packages respectively of fruits, vegetables and plants, making a total for the two years of 484,989 packages. As compared with the same period for 1909-1910 there was shown an increase of 97,928 packages inspected.

Owing to the very rigid inspection by our entomological officials a very marked improvement in the quality of fruits and vegetables coming from the mainland has been noticeable. The recently improved State and County inspection of fruit shipments at the Coast has also materially contributed in causing growers or producers to make a better selection of products intended for exportation.

In a large number of consignments from the Orient, Polynesia and Australasia, as well as the Mainland, there have been discovered and destroyed numerous injurious insect pests which as yet are fortunately not established in this Territory. It is safe to say that where one insect pest is imported either in plants or other vegetation surreptitiously introduced, a thousand are kept out by the rigid and systematic inspection maintained by this Department.

EQUIPMENT FOR FUMIGATION AND INSPECTION WORK.

It is quite fortunate that the inspection equipment, comprising laboratories and fumigating chambers on three of the main docks, have been equal to the emergencies which upon occasions have arisen. Because of this fact much time, labor and expense have been saved in handling large Coast shipments of vegetation and the great danger of accidentally introducing some pest has been practically overcome, as these consignments do not now have to be transported from one dock to another for fumigation.

Very large shipments of rice, beans and other cereals continue to arrive from Japan on practically every steamer, and these on occasions are more or less infested with weevils. Up to the present such shipments have been hauled at great expense to the Channel Wharf where there are two large gas-proof compartments suitable for handling such large consignments. These fumigating rooms have, however, out-served their usefulness, and like the wharf itself are almost beyond repair for the purpose intended. Provision should at once be made for one or more extra large gas-tight fumigating rooms adjacent to one of the principal wharves in the city so that these large Oriental shipments of infested cereals can be properly handled for the future.

INTER-ISLAND INSPECTION.

Owing to the presence of several insect pests and fungus diseases injurious to agriculture on Oahu, which have not as yet made their appearance on the other islands, it was deemed advisable to pass regulations to prevent sugar cane, plants or other vegetation and soils from being exported to the other islands without having first been inspected and passed by the Superintendent or his assistants. Unfortunately funds were not available for the extension of this important service and it was therefore handicapped very materially at its inception. Added to this particular work was the additional service required of the inspectors when it was decided to use all reasonable means to prevent Fruit Fly from leaving Oahu in infested fruits. It was however soon found that fruits, unlike plants and other vegetation, could be surreptitiously carried in baggage, and that the inspectors were legally helpless in demanding an inspection of personal belongings. In consequence Fruit Fly shortly made its appearance on the other islands and that particular feature of inspection has been discontinued, more particular as the County authorities in Hilo, Kau and the larger part of Maui, which are the only districts where the pest has not yet appeared, are, with financial assistance from the Board of Commissioners, inspecting importations from Honolulu at their several home ports.

During the period covered by this report there have been 1072 inter-island steamers attended to, and of 10,966 packages of plants, fruits and vegetables inspected 1800 packages were refused shipment because of infestation with pests, or because of having infected soil attached to the roots of plants.

FRUIT FLY CONTROL.

This work was commenced in Honolulu in November, 1911, or just as soon as funds were made available for the purpose. Owing to the large demands made on the Conservation Fund Committee for funds for other departments, those available for Fruit Fly work were inadequate in view of the very badly infested condition of fruit over the whole of Honolulu and suburbs as well as in sections adjacent thereto.

Fortunately the Horticultural Commissioners of the State of California offered to contribute financially for a limited period and thereby co-operated in the system of clean culture control already inaugurated by this Board. This co-operation and assistance from the California Horticultural Commission through Mr. Weinland, the local representative, commenced about the first of 1912, four extra inspectors being employed in February and continued until November of the same year at which time the Bureau of Entomology, having in charge the expenditure of funds appropriated by Congress for fruit fly work, decided to send one of its own staff to continue the campaign already well under way. On Aug. 29, 1912, Dr. E. A. Back, the Federal officer referred to, arrived accompanied by the Acting Chief of the Bureau of Entomology, Washington, D. C. Both these gentlemen immediately commenced an investigation of fruit fly conditions in Honolulu and later concluded that the system of control by clean culture methods as adopted by this Board would continue under Federal supervision, and in co-operation with the Territorial Board of Agriculture and Forestry. The full control of the campaign against the fruit fly pest in Honolulu by artificial means was therefore turned over to Dr. E. A. Back on Sept. 16, 1912, and since that date a portion of the appropriation made by Congress has been used by the Federal representative to increase the staff of inspectors and to extend experimental laboratory work. Dr. Back and his staff are making the offices of this Board their headquarters during a continuance of the campaign. The heartiest co-operation has existed and still exists between this Board, its Superintendent of Entomology and the representative of the U. S. Bureau of Entomology, and all possible is being done to prevent any further increase in the infestation of fruits on Oahu, whether being raised for home consumption or export, or growing wild. Unfortunately neither the Territorial nor the Congressional appropriation has been adequate effectually to grapple with conditions on the neighboring islands and to do this as well as the Oahu work successfully would need a very large additional and continuous appropriation. The fact that the Congressional appropriation is not continuous, while it is absolutely necessary that methods of clean culture control must be continuous in order to be efficacious, makes the future status of fruit fly control here rather doubtful at the present time. In the event of a successful termination of the search for a specific and effective parasite on the fruit fly now under way, and its successful introduction and establishment in these islands, that method of natural control of the pest would undoubtedly do away with the expenditure of large sums now being used, not only for the purpose of checking the fruit fly but for the equally if not more important one of securing admittance into California and other West Coast States of our large consignments of bananas and pineapples. This Board and the public generally undoubtedly recognize the fact that unless the pest is under control at the port of shipment the fruit products just mentioned under existing regulations will be barred from Western Coast ports as is now the case with other fruits which are at present quite susceptible to fruit fly attack.

The search for a specific and efficient parasite on the Mediterranean Fruit Fly as well as one on the Cotton Boll Worm began last July. Failing to secure the services of Prof. Koebele, who unfortunately was in poor health, Dr. F. Silvestri, a well known and recognized entomologist who is particularly fitted for research work of this kind, left for West Africa, the home of the genus of fruit flies to which our species belongs. The long distance between African ports and this Territory makes communication difficult because of delays and irregularities in mail connections, but notwithstanding this fact this Board has kept fairly well in touch with Dr. Silvestri and at last accounts (November 30th) he had investigated portions of Senegal, French Guinea and Nigeria, breeding out and securing at one or more sections of these African States various parasites on fruit flies closely allied to the Mediterranean Fruit Fly. Unfortunately for us he has not as yet discovered our particular species of fruit fly and with one exception the parasites bred out by him have not as yet indicated that they would be satisfactory for the purpose intended. The exception referred to cannot of course be experimented with until fruit containing our species of fruit fly has been secured by Dr. Silvestri in sufficient quantity to breed with. The Federal as well as Territorial laws prohibit the introduction into the Territory, even for experimental purposes, of fruit fly material unless it can be absolutely assured that the species to be introduced is already established at point of destination. This, it is to be understood, is to make it practically impossible to introduce new pests and have them handled in laboratories by inexperienced men.

From Nigeria Dr. Silvestri has gone to the Congo and Angola, and at either of these places he is in hopes of meeting with additional success. So far he has not come across the species of

Cotton Boll Worm which infests our cotton here and for which he is also searching for a parasite.

HORN FLY PARASITE WORK.

Owing to the serious condition of health of Prof. Koebele and his inability to search for a parasite for this cattle pest beyond the confines of his home in Europe, the Board decided for lack of funds to discontinue his services temporarily. The Hawaiian Sugar Planters' Association, however, which has been co-operating financially and otherwise in this important work, continues the services of Prof. Koebele under a special arrangement, and if that scientist's health improves it may be possible for the Board to secure his services later on if it is desirable to do so. The parasitic material on Horn Fly sent by Prof. Koebele during the period of 1911-12 has by mutual arrangement been handled by the Experiment Station of the Hawaiian Sugar Planters' Association, and a report regarding the result of this work is appended to that of the Superintendent of Entomology.

FIELD INSPECTION OF AGRICULTURAL AREAS.

The result of fruit fly infestation in Honolulu, as well as the continued shipments from this port to San Francisco of bananas and pineapples affected with scale insect pests, brought about a much more strict and vigorous inspection and occasional fumigation of these shipments by the Horticultural Commissioners of the State of California than had been previously the case. The vigorous attitude assumed by the San Francisco inspectors as to scale insects and the possible introduction of the fruit fly into California alarmed our producers of bananas and pines to such an extent that, in order to prevent a severe loss on shipments by either their rejection or fumigation, it was decided by the Board to request the Superintendent to give as much time and attention to field inspection as was possible without interference with his other important duties. Upon investigation of many banana fields they were found in very bad condition, the old system of leaving dead and decaying stumps and foliage to remain among the growing trees being still maintained. It was also found that very many groves of banana trees were badly infested with scale insects. Upon the advice of the Superintendent a Regulation (Rule XII) was formulated and passed by the Board which would give legal authority to cause the cleaning up of not only banana groves but also of neglected fields of cotton, pineapples, etc. After adopting this Regulation the Board found itself with insufficient funds to employ special gangs of inspectors to clean up these infested areas and therefore arranged to have much of this work as well as the inspection of fruits for export done by the Superintendent of the Territorial Marketing Division. Up to the departure of Mr. Weinland, the representative of the California State Horticultural Commission, this work continued under the charge of the Marketing Division with Mr. Weinland's assistance and the co-operation of the Superintendent of Entomology. Upon the arrival of Dr. E. A. Back, the representative of the U. S. Bureau of Entomology, all this work was taken up solely by him and he is now continuing this inspection and cleaning up of banana groves very efficiently, thereby making it possible to continue shipments of bananas and pines to the West Coast.

RECOMMENDATIONS.

The steady increase of fruit and plant shipments arriving in Honolulu from the Orient and the Coast, added to the fact that the completion of the Panama Canal will bring the Territory into direct communication with Central and South America, as well as Mexico, makes it quite apparent that ample funds for the extension of the work connected with inspection and fumigation of imports will be made necessary during the next biennial period. The necessity of continuing and extending inter-island inspection and fumigation is also of paramount importance, because of reasons previously explained. Should any serious pest accidentally get a foothold at Honolulu, which will undoubtedly be the port of entry for through steamers coming through the Canal, en route to and from the Far East, the inter-island inspection if efficiently and legally maintained can be the means of keeping an introduced pest from spreading to the agricultural districts on other islands for a long period. Were it not that there are so many insular ports in the Territory it would of course be far preferable to have trained inspectors at all the landings and have all imports of fruits, plants and vegetation examined at point of destination. It is obviously impossible, however, to do this without incurring very great expense and therefore all the work of inspection of such material from Honolulu will have to be conducted in the future as in the past at the port of Honolulu. With the large increase of shipments anticipated, this inter-island work at Honolulu can be efficiently conducted only if funds are forthcoming for the purpose. At the present time there are two serious pests on Oahu which so far as known have not yet become established on the other islands, viz., a grub attacking the roots of sugar cane and a weevil which attacks the fern products of our watersheds. Both these pests have been established on Oahu for some years. The grub so far has damaged cane but locally and has not yet distributed itself to all the agricultural districts. On the other hand the weevil has practically destroyed all the tree fern growth on large sections of the mountains back of Honolulu, causing much damage to the forest cover. Very serious conditions may result if this pest becomes established in the large water-bearing forest areas on the different islands.

During the last session of the Legislature attention was drawn to the numerous complaints received from small farmers and horticulturists of the damage and loss to their crops through the attacks of the Melon fly, Fruit fly, Alligator pear and Mealy bug, Japanese beetle and Cotton Boll Worm as well as other pests, which can at best under present circumstances only be kept under control by artificial means and by the most careful supervision at considerable expense. The Board would again recommend the appropriation of necessary funds for the search, introduction, propagation and distribution of such natural parasites and predaceous insects as would tend effectively to control the pests named and thereby, if possible prevent some of the losses complained of by the producers.

As financial assistance for the control of fruit fly by artificial means, as now operated by the U. S. Bureau of Entomology, cannot be promised indefinitely, the Board recommends that a special appropriation be made for the continuation of this work during the next biennial period, the sum appropriated to be used only in the event of aid being withdrawn or in that of the present federal appropriation lapsing.

DIVISION OF ANIMAL INDUSTRY.

REGULATIONS.

During the past period the rules and regulations of this Division have been found effective and satisfactory with but one exception. A steadily increasing epidemic of rabies has been spreading over the United States until, about three years ago, it crossed the Rocky Mountains and invaded the Coast States. In order therefore to protect the Territory against this most dreaded of all diseases among animals as well as mankind, a new regulation was promulgated, requiring the quarantine of all dogs for a period of 120 days before admission. After having been in effect for nearly one year, and notwithstanding objections which were at the start raised by importers to this regulation, practically all dog owners have come to realize the necessity of the measure. The enforcement of this regulation has so far almost doubled the inspection work of the Division, and necessitated the outlay of considerable of the Board's funds for the construction and equipment of kennels and enclosures. The expectation of the Board that so severe a measure would reduce the number of dogs importd to a minimum was not altogether realized. Since the regulation went into effect there have arrived and been quarantined a total of 89 dogs, as compared with 115 dogs during the same period the year before. Only one dog has died in quarantine, a case of heart failure, while 14 have been born, and while the location of the Station on the Beach Road, between Ward avenue and Sheridan street, makes it more or less warm during the summer months, there is nearly always a cool breeze from the mountains and shade is provided by trees and awnings. Long-haired and heavy-coated dogs, as setters, spaniels, and other water dogs which suffer most from the heat, are allowed the use of a concrete swimming tank as often as required, and it may be said that up to this time no single dog owner who has visited the station has expressed anything but approval of the arrangements made for the comfort and health of their pets during the prolonged detention.

The continued spread of rabies in the United States and other countries, as testified to by the official reports of numerous boards of health; the number of persons bitten, and dogs and other animals destroyed after developing the disease, which are counted by the thousands; the Pasteur laboratories for the treatment of bitten people which have been established wherever the disease has made its appearance (in California alone not less than eight); all testify to the necessity of the action which was taken by the Board in passing the Regulation referred to. (See Rule VI).

LIVE STOCK CONDITIONS IN GENERAL.

The past biennial period has been very favorable so far as live stock sanitary matters are concerned, no epidemic of any importance having occurred and even the fly pests seeming to have subsided to a certain extent. A more or less prolonged drought has, however, caused losses of cattle and sheep in certain sections of nearly all of the Islands, and had it not been for the lesson learned four years ago, when nearly 15,000 head of cattle died for lack of water, the situation would undoubtedly have been serious. The building of the Kula pipe line on Maui, and the storing of water in reservoirs in many other places, may be said to have saved the lives of 30,000 head of cattle at a low estimate, and the appearance of any endemic or epidemic disease at the time would undoubtedly have played havoc with live stock. On the other hand the drought has no doubt put a check to the spread of parasitic diseases, both external and internal, which always flourish in wet seasons.

IMPORTATIONS OF LIVE STOCK.

With the exception of horses and mules belonging to the U. S. military forces, there have arrived in the Territory approximately the same number of animals as in the past few years. The class and quality of draft animals have, however, been far in advance of what used to be sent here and the altogether too common method of "stuffing" each shipment with a few worthless animals, has practically disappeared. As far as cattle are concerned the recent importations of breeding stock have shown steady progress until some of the last shipments consisted of blue ribbon and State or National champions, especially of the Hereford breed. The effect of such importations upon the beef production of the Islands cannot be over-estimated especially when viewed from a military standpoint. Nevertheless, the arrival of thousands of officers and soldiers has caused the consumption of beef and other meat food products to increase to such an extent that frozen or chilled beef must be imported to the extent of more than a million pounds per annum. Mutton is also imported to a certain extent, while pork is now supplied almost entirely by the local hog raisers.

Dairy products, such as butter, cream and cheese, as well as poultry and eggs, remain unchanged so that more than ninety per cent of the total consumption is imported from abroad with little prospect of any change in the near future.

DISEASES OF LIVE STOCK.

The Territorial Veterinarian and his deputies report a highly gratifying absence of infectious or contagious diseases among the live stock of the Territory during the past period. This in connection with the almost complete eradication of glanders and the gradually increasing control of bovine tuberculosis, not to mention the continued absence of hog cholera, Texas fever, blackleg and anthrax, tends to make live stock conditions here almost ideal. When considering the hundreds of millions of dollars that are lost annually in the United States as a result of the above mentioned diseases alone, it should not be necessary to point out the wisdom of measures preventing their gaining entrance here.

Cerebro spinal meningitis in horse stock has increased slightly, a few dozen cases having been reported from the four larger islands, but this remains insignificant when compared with the overwhelming extent to which this disease has prevailed on the Mainland during the past year, the States of Kansas and Nebraska alone suffering a loss of more than 25,000 head from this disease alone.

The Eradication of Glanders has been one of the principal objects of this Division for years and the Territorial Veterinarian points with pride to the reports of his deputies as well as to his own observations, which all tend to show that this destructive and dangerous disease has probably made its last stand here with the recent outbreak among the horses in Waipio Valley on Hawaii. These good results are attributed in this report principally to favorable climatic conditions, to the absolute exclusion of fresh infection from without through the means of inspection, testing and quarantine, and to the unrelenting pursuit of the disease within the Territory, which latter has been made possible only by the vigilance of the Deputy Territorial Veterinarians. During the year 1908 the known loss from this disease was between $30,000 and $40,000, while at present it is estimated that the sum of $1,000 will about cover the destruction of all remaining cases in the Territory, were that sum appropriated for the purpose.

BOVINE TUBERCULOSIS CONTROL WORK.

This would seem to be the subject above all others to which the Animal Industry Division has devoted itself, and now that the great international controversy in regard to the relationship and transmissibility of animal and human tuberculosis has been definitely settled, it would seem that *no effort to eliminate this source of human infection*—milk from tubercular dairy cows—*should be neglected.*

The Territorial Veterinarian believes that the complete eradication of bovine tuberculosis cannot be accomplished without reasonable financial assistance in reimbursing the owners of tuberculous animals which have been destroyed, pro bono publico, out of the Treasury of the Territory. As this policy has been adopted by many States in the Union and in many foreign countries, and as the death rate from the disease is greater here than in any other country, it seems almost criminal to allow this one source—*infected milk*—to continue to do its deadly work when the expenditure of a comparatively small sum of money would put a stop to it. It is, of course, out of the question here to enter into a discussion of the pros and cons pertaining to the subject, and those interested are referred to the detailed report of the Territorial Veterinarian, which is carefully worked out and is based on work done and methods adopted in the countries which lead in the control and eradication of tuberculosis, both human and animal. It must, however, be said that the results obtained in the City and County of Honolulu, in reducing the percentage of bovine tuberculosis from nearly 30% to less than 4%, within a period of less than three years, and without the expenditure of any public moneys beyond those appropriated for the routine work of the Division, give great hope that many human lives can be saved and the health, happiness and prosperity of the inhabitants of the Territory be vastly increased by the extension of the bovine tuberculosis control work to the entire Territory, by the appropriation of the funds recommended in the accompanying report.

INSPECTION AT SAN FRANCISCO.

The much deplored death of Dr. Geo. T. Baker, federal inspector of live stock for the port of San Francisco, who for years has effectively guarded the Territory against the introduction of these various forms of infection through the inspection and testing of all animals intended for export to the Islands, has left a feeling of unrest and insecurity, engendered by the arrival in a few instances of animals unaccompanied by the requisite certificates of health, which condition must be remedied at any cost.

QUARANTINE STATIONS.

Honolulu: As already mentioned the promulgation of the Rabies quarantine regulation necessitated the addition of a dog division to the animal quarantine station in Honolulu. This consists of 18 kennels, six of which are double, allowing of the segregation of 24 dogs at the same time. Besides the kennels there is a sheltered but open work-room and laboratory and a sheltered concrete wash-room with swimming tank for the dogs. One room and a cook-room or kitchen was added to the office, for the use of the keeper who is in constant attendance at all hours.

The main quarantine station has suffered considerably from wear and tear during the past two years and will need a complete overhauling as soon as funds therefor are available.

Hilo: The Hilo Quarantine Station has been awaiting the securing of a satisfactory site. This has but recently been obtained by a surrender of lease from the Waiakea Mill Company, and consists of three acres located in the old Shipman slaughter house pasture a little beyond the entrance to the Waiakea Mill on the road to the Volcano, about one mile outside the town. The plans and specifications for the construction of the station are now ready and tenders will be advertised for in the near future.

Kahului: The importation of a considerable number of live stock to Maui direct during the past period, has made it desirable that quarantine premises be provided for this Island so as to avoid unloading and reshipping at Honolulu. A site of 2.7 acres, located a short distance from Kahului on the road to Puunene, has been secured and it is expected that the construction of the station can be begun before long.

The constantly increasing number of imported animals, in connection with the dog quarantine, will necessitate the employment of an assistant keeper at Honolulu as well as a keeper each for Hilo and Kahului.

RECOMMENDATIONS.

The Board therefore recommends:

(a) That every facility be provided the Division of Animal Industry for the continued effective exclusion of animal scourges from the Mainland or from abroad, such as adequate quarantine premises at the various ports of entry; the employment of assistants, caretakers and laborers for the maintenance and sanitation of such establishments and for the care and comfort of the animals therein; and, finally, the unrelenting prosecution of violaters of the regulations of the Board pertaining thereto.

(b) The complete eradication of glanders from within the Territory can and should be accomplished in the near future, and the request of the Territorial Veterinarian for the sum of $1,000.00 for the reimbursement of owners of diseased animals which may still remain either secluded or unapprehended should meet favorable consideration. The same applies to the reimbursement of the owner of glandered horse stock in Waipio Valley, whose twenty-eight head of diseased or infected animals were very recently destroyed by order of this Board, the owner co-operating and lending his aid in every possible way in order to exterminate the disease.

(c) The extension of the bovine tuberculosis control work to include the entire Territory, such owners of tuberculosis dairy cattle who have endeavored to clean their herds and who continue to co-operate with the Board for this purpose to be reimbursed for subsequent cases destroyed for the protection of public health.

(d) The recommendations of the Milk Commission of 1910, "That the control of milk be taken from the municipality and given to the Territorial Board of Agriculture and Forestry in order to secure protection for the entire Territory"; and that of the Sanitary Commission of 1911, "that a heavy fine be imposed on any person convicted of selling milk from cows infected with tuberculosis", meet with the full approval of the members of this Board.

(e) That the live stock sanitary service outside the City and County of Honolulu be permanently established and regulated by the payment of adequate salaries and traveling expenses to the deputy territorial veterinarians, the Board realizing that without their practically gratuitous services in the past the control of glanders could not have been accomplished. The future services of these veterinarians must be enlisted to a far greater extent in the control and eradication of bovine tuberculosis, providing it is required that this shall be extended over the whole Territory.

PURE SEED LAW.

At the last session of the Legislature there was enacted a pure seed law (Act 107, Laws of 1911), designed to regulate the importation of seed and prevent the introduction of weed pests into the Territory. No appropriation was made for the enforcement of this law, so that it is only of weight through its moral effect. Its proper enforcement requires the employment of a person technically trained in seed analysis. Such an official should be attached to the Board of Agriculture and Forestry. As well as having charge of the inspection and analyses of all seeds coming in, he could also well carry on investigations in regard to trees and plants new to the Territory which are considered desirable to be introduced.

CONCLUSION.

In concluding this report and submitting those of the Divisions of Entomology, Forestry and Animal Industry your special attention is called to the various recommendations made and to the reasons given therefor. Each of the Divisions is rendering practical service to the people of the Territory and the work already performed and that in contemplation is of such importance not only to all Agriculturists but to the Territory as a whole, that it is to be hoped that the Board and its several Divisions will receive adequate support financially and otherwise.

Respectfully submitted,

W. M. GIFFARD,
President and Executive Officer;

J. M. DOWSETT,
H. M. VON HOLT,
ALBERT WATERHOUSE,
ARTHUR M. RICE,
Commissioners.

ALLOTMENTS AND EXPENDITURES

BOARD OF AGRICULTURE AND FORESTRY

For the Biennial Fiscal Period Jan. 1, 1911—Dec. 31, 1912.

GENERAL FUND.

January 1, 1911 to December 31, 1912.

Allotments.

Mar. 31, 1911	By Conservation Board for a period from Jan. 1, 1911 to March 31, 1911	$ 7,634.59	
May 12, 1911	By Conservation Board for a period from April 1, 1911 to June 30, 1912	54,500.00	
July 1, 1912	By Conservation Board for a period from July 1, 1912 to June 30, 1913	48,000.00	
Total amount alloted for 30 months, Jan. 1, 1911, to June 30, 1913			$110,134.59

Summary of Expenditures.

Jan. 1, 1911 to Mar 31, 1911	$ 7,634.59	
Apr. 1, 1911 to June 30, 1912	50,161.42	
July 1, 1912 to Dec. 31, 1912	19,288.80	
Total Expended, 24 months	$77,084.81	
Amount lapsed, June 30, 1912	4,338.58	
		$ 81,423.39
Unexpended balance, Dec. 31, 1912		$ 28,711.20

STATEMENT OF EXPENDITURES.

	1911	1912	1911-12		Total expenses and pay rolls 1911-12
General Board					
Including Administration for All Divisions					
Current Expenses					
Routine	$ 499.89	$ 482.73	$ 982.62		
Stables	1,047.97	679.27	1,727.24		
Publications	1,999.14	783.50	2,782.64		
Advertising	222.40	158.10	380.50		
Stationery and Postage	379.92	411.60	791.52		
Library	469.20	411.43	880.63		
Traveling Expenses	12.25	174.27	186.52		
Office Supplies	141.00	194.30	335.30		
Incidentals	170.79	636.21	807.00		
Repairs to Buildings		111.22	111.22		
New Building	....	1,593.50	1,593.50		
Total	$4,942.56	$5,636.13	$10,578.69	$10,578.69	
Pay Rolls					
Salary Clerk	$1,775.00	$1,575.00	$ 3,350.00		
Pay Assistants, Employees and Laborers	2,339.50	3,618.43	5,957.93		
Total	$4,114.50	$5,193.43	$ 9,307.93	$ 9,307.93	$19,886.62

Forestry Division					
Current Expenses					
Extension	$ 172.11	$ 327.33	$ 499.44		
Arbor Day	....	111.60	111.60		
Herbarium	179.42	1.50	180.92		
Travel	182.36	295.44	477.80		
Forest Reserves	25.00	2.10	27.10		
Incidentals	248.74	267.66	516.40		
Nurseries—Oahu	....	94.04	94.04		
" —Hawaii	....	83.75	83.75		
" —Kauai	....	63.55	63.55		
Total	$ 807.63	$1,246.97	$ 2,054.60	$ 2,054.60	
Pay Rolls					
Salary Superintendent	$3,000.00	$3,000.00	$ 6,000.00		
Pay Assistants, Employees and Laborers	6,765.05	5,813.43	12,578.48		
Total	$9,765.05	$8,813.43	$18,578.48	$18,578.48	$20,633.08
Entomology Division					
Current Expenses					
Inspection	$ 278.96	$ 104.60	$ 383.56		
Travel	387.45	350.83	738.28		
Laboratory Supplies	14.78	60.54	75.32		
Incidentals	43.30	84.76	128.06		
Total	$ 724.49	$ 600.73	$ 1,325.22	$ 1,325.22	
Pay Rolls					
Salary Superintendent	$3,000.00	$3,000.00	$ 6,000.00		
Pay Assistants, Employees and Laborers	3,865.35	3,199.50	7,064.85		
Total	$6,865.35	$6,199.50	$13,064.85	$13,064.85	$14,390.07

STATEMENT OF EXPENDITURES.

	1911	1912	1911-12		Total expenses and pay rolls 1912-12
Animal Industry Division					
Current Expenses					
Travel	$ 949.40	$1,173.58	$ 2,122.98		
Laboratory Supplies	231.73	93.16	324.89		
Quarantine Station—Honolulu	909.59	778.64	1,688.23		
Bovine Tuberculosis Control	771.51	283.64	1,055.15		
Incidentals	67.95	172.04	239.99		
Purchase of Automobile	525.00	1,575.00	2,100.00		
Dog Quarantine—Honolulu	....	1,774.86	1,774.86		
Quarantine Station—Hilo	....	42.00	42.00		
Total	$3,455.18	$5,892.92	$ 9,348.10	$ 9,348.10	
Pay Rolls					
Salary Superintendent	$3,000.00	$3,000.00	$ 6,000.00		
Pay Assistants, Employees and Laborers	3,190.00	3,636.94	6,826.94		
Total	$6,190.00	$6,636.94	$12,826.94	$12,826.94	$22,175.04
Expenditures for two years, 1911-12; Grand Total, All Divisions					$77,084.81

SPECIAL APPROPRIATIONS.

Combatting Mediterranean Fruit Fly.

Allotment		$6,750.00
Expenditures		
Current Expenses		
Oct. 1, 1911, to Dec. 31, 1912	$2,234.72	
Pay Rolls		
Oct. 1, 1911, to Dec. 31, 1912	2,650.65	
Total		$4,885.37
Unexpended Balance, Dec. 31, 1912		$1,864.63

Hawaii Inspection, Fruit Fly.

Allotment		$3,500.00
Expenditures, Oct. 1, 1911 to Dec. 31, 1912		
Current Expenses	$ 255.35	
Pay Rolls	1,759.50	
Total		$2,014.85
Unexpended balance Dec. 31, 1912		$1,485.15

Maui Inspection Fruit Fly.

Allotment	$1,000.00

Remains unexpended Dec. 31, 1912.

Parasites Fruit Fly and Boll Worm.

Allotment		$6,000.00
Expenditures, Oct. 1, 1911 to Dec. 31, 1912		
Current Expenses	$2,988.57	
Pay Rolls	1,200.00	
Total		$4,188.57
Unexpended balance, Dec. 31, 1912		$1,811.43

Planting and Fencing Kohala Forest Reserve

Allotment	$3,000.00
Expenditures, May 15, 1911, to June 30, 1912	2,921.60
Balance lapsed June 30, 1912	$ 78.40
Allotment	$1,947.25
Expenditures to Dec. 31, 1912	500.00
Unexpended balance, Dec. 31, 1912	$1,447.25

Special Fund on Deposit

Alloted for use re Kohala Forest Reserve, unexpended	$2,955.00
Total Amount available for Kohala Forest Reserve	$4,402.25

Pupukea Forest Reserve

Allotment	$3,500.00
Expended	2,097.50
Balance lapsed	$1,402.50

Construction of Animal Quarantine Stations

(Hilo and Kahului)

Allotment, July 1, 1912	$4,000.00

Remains unexpended Dec. 31, 1912.

Plant Inspection Other Islands

Allotments			$5,900.00
Jan. 1, 1911	$3,500.00		
July 1, 1912	2,400.00		
Expenditures			
Current Expenses		$ 318.45	
Pay Rolls		3,125.00	
Total Expenditures		$3,443.45	
Balance Lapsed, June 30, 1912		984.35	4,427.80
Unexpected balance, Dec. 31, 1912			$1,472.20

APPENDIX
TO REPORT OF
THE COMMISSIONERS OF AGRICULTURE AND FORESTRY

Some Observations on Hawaiian Forests and Forest Cover in Their Relation to Water Supply

BY WALTER M. GIFFARD

LETTER OF TRANSMITTAL.

To the Joint Committee on Forestry,
Hawaiian Sugar Planters' Association and
Board of Agriculture and Forestry.

DEAR SIRS:—I beg to submit you for your consideration a paper entitled "Some Observations on Hawaiian Forests and Forest Cover in Their Relation to Water Supply."

Respectfully,

W. M. GIFFARD.

Honolulu, January 20, 1913.

JOINT COMMITTEE ON FORESTRY.

H. S. P. A.	Bd. of A. & F.
Albert Horner, Chairman,	W. M. Giffard, Chairman,
E. D. Tenney,	H. M. von Holt,
E. F. Bishop.	A. H. Rice.

SOME OBSERVATIONS ON HAWAIIAN FORESTS AND FOREST COVER IN THEIR RELATION TO WATER SUPPLY.

A paper by W. M. Giffard read before the Joint Committee on Forestry of the Hawaiian Sugar Planters' Association and the Territorial Board of Agriculture and Forestry.

The Nature and Peculiarities of the Wet Forests of Hawaii and the Cause of Their Deterioration and Decline.

Much has been written on this subject and at first thought it may appear quite unnecessary that further explanation be made of the composition and nature of the Hawaiian forests that are needed for drainage or the conservation of water supply. It is, however, very apparent that there are still a number of individuals in the Territory that up to the present have ignorantly, carelessly or wantonly disregarded the oft repeated warnings of foresters and botanists as to the necessity for protecting these forests. Clearings continue to be opened up through the encroachment of man and beast, and the forest in places is still being pushed back by the making of clearings and roads to these that ought never to have been permitted. Elsewhere, the cutting of the forest for posts and for firewood is still going on, and again, where wild cattle and hogs are at large in the forest, general destruction is caused by their roaming around grubbing and feeding on and trampling down the herbaceous undergrowth so necessary for soil and water protection.

It is well understood by all having knowledge of the peculiar nature of these virgin forests that much of their natural undergrowth, composed as it is of climbing vines (lianes) and herbaceous plants, ferns and mosses, not only protects the soil from erosion but furnishes a protective cover for the surface growing roots of our indigenous trees.

Take for instance the native Ohia Lehua, which attains such fine growth in these wet forests and of which they are in the main composed. No observing person passing through such a forest can have failed to notice the peculiar stilt-like roots of the Ohia. This characteristic habit of growth is explained by the epiphytic habits of the Ohia. The tree has developed from seed, which dropped on the stem of some stately tree fern or Cibotium, germinated there and sent down its own roots, surrounding the fern, until both for a time became as it were, one. Later, the fern stump having decayed, the Ohia stands supported by its own roots.

Further, it will be noticed that not only the Ohia, but also several other species of trees peculiar to these forests have only surface roots, and that these are not altogether dependent on the usually thin layer of rich but boggy humus, but as well, rely on the ground cover of mosses and roots of ferns with which their own roots are intermingled.

Very many of our land owners, or those having the use or care of such forests, have the idea that if the trees themselves are not destroyed or disturbed, the forest will continue in its virgin state. These people forget that the very act of disturbing or destroying the undergrowth is in itself the main factor in causing the trees themselves eventually to die back. The loss of numbers of trees from one cause and another naturally admits more sunshine to the undergrowth than the latter has ever been accustomed to or can stand. The natural consequence is its death, which in turn leads to the dying back of more trees, and to the still further destruction of the forest.

Under such conditions it then becomes merely a matter of a short time, especially if animals are allowed to range in the forest, or if clearings are made for any purpose, before the Hilo grass or other rank growing introduced plant pests get a foothold. By the crowding out and prevention of the reproduction of the native flora, there follows either the general destruction of the forest outright or its degeneration to such an extent that it ceases longer to be of use for the purpose which it originally served, viz—the retention and conservation of our water supply.

As regards the encroachment of grasses into the forests and their effect on trees and other growths, it has been scientifically demonstrated by a long series of experiments in Europe and elsewhere, that the injury is not altogether due to the grass crowding out and mechanically interfering with the roots of other plants, but to a toxin excreted from, or resulting from the growth of the grass. However, as both effects are injurious to the forest it is clear that such pests must be excluded.

From what has been said above the following can be scientifically and therefore safely deduced, viz:

(1). That to keep our forests and sources of water supply in a natural condition the jungle of woodland and undergrowth therein must be left altogether undisturbed by man or beast.

(2). That preventive measures for safeguarding the existing forests by fencing, ranging and policing as well as destroying wild cattle, hogs and goats, should be systematically undertaken by the Forestry Division of the Territorial Board of Agriculture and Forestry.

(3). That in order effectively to undertake such important work the privately owned areas within the water-bearing forest reserves should be brought under the same system of management that is here recommended for the Government lands, in such manner as is already provided for by law. A proper system of forest protection having been established by the Government, failure to assign forest lands to the Territory for the specific purpose of protection might, as a last resort, be followed by condemnation proceedings, it being understood that any neglect on the part of the Government properly to protect and police such acquired reserves would forfeit the latter's right to the ownership; and

(4). That the Legislature appropriate sufficient funds for the special purpose of fencing and policing the forests above referred to, and excluding therefrom wild cattle, etc.

The Intermediate Forest Areas and Their Relation to the Water Sheds.

From an economic point of view the so-called intermediate forests, i. e. the areas of woodland between the agricultural and mountain zones and the wet forests on the water sheds are of as much importance for the protection and preservation of the areas forming the virgin wet forests as these latter are in helping to control the drainage, retention and conservation of water for the supply of agricultural lands, or such other purposes as the water may be needed for. The close observer of our natural forests and water sheds will at once notice that where the wet forests are still in their virgin condition, the areas both above and below the wet forest are of somewhat different nature than those from which we expect to and do receive our water supply.

Taking Hawaii and Maui as examples, one finds that the extreme upper sections of the middle forest zone, above the true wet forest, are composed of a more or less scrubby growth of indigenous trees with an undergrowth of dry district ferns and raspberries, technically described as semi-xerophytic in character.

This upper belt of rather open forest gradually increases in density as one descends into the true wet forest zone, until it intermingles with the latter. The undergrowth also becomes thicker and composed of a greater number of species, until it reaches the ideal wet forest conditions, which are so necessary for a continued water supply at all periods of the year. Technically this type of forest is said to be mesophytic in character.

Again, taking the same islands for an example we find on the lower edge of the wet forest belt a similar state of things. There also the typical wet forest merges into a transition type which may or may not be composed of the same species that are to be found in the wet forest, but which in character is different from the wet forest above. In places also the section between the wet forest and the area of land now under cultivation is covered by a scrub forest and the introduced guava.

The point to be made is that it is of paramount importance to protect, as necessary adjuncts of the forest system, not only the main wet forest but also these intermediate areas. Nature has provided that these so-called intermediate conditions of forest are requisite to the proper and natural protection of the flora contained in the wet forests on the water sheds.

Of course the formation, botanical composition and geographical position of some of our water sheds on other islands than those named, where they are not of the same general character as those described, are equally worthy of consideration when studying the natural conditions which are necessary to their proper protection. Let us take for instance Oahu. This Island has had all the lands adjacent to the mountains, i. e. the water shed areas, stocked with cattle, so that comparatively little is left of any forest other than what may be found on the high ridges and plateaus. Even in these places, which might be supposed to be almost inaccessible, cattle and also goats have trespassed more or less and damaged the forests on which so much depends in the way of water conservation. The result is that there are practically no intermediate or scattered forest areas existing on Oahu at this time, this section having been in the main given up to the graziers and others.

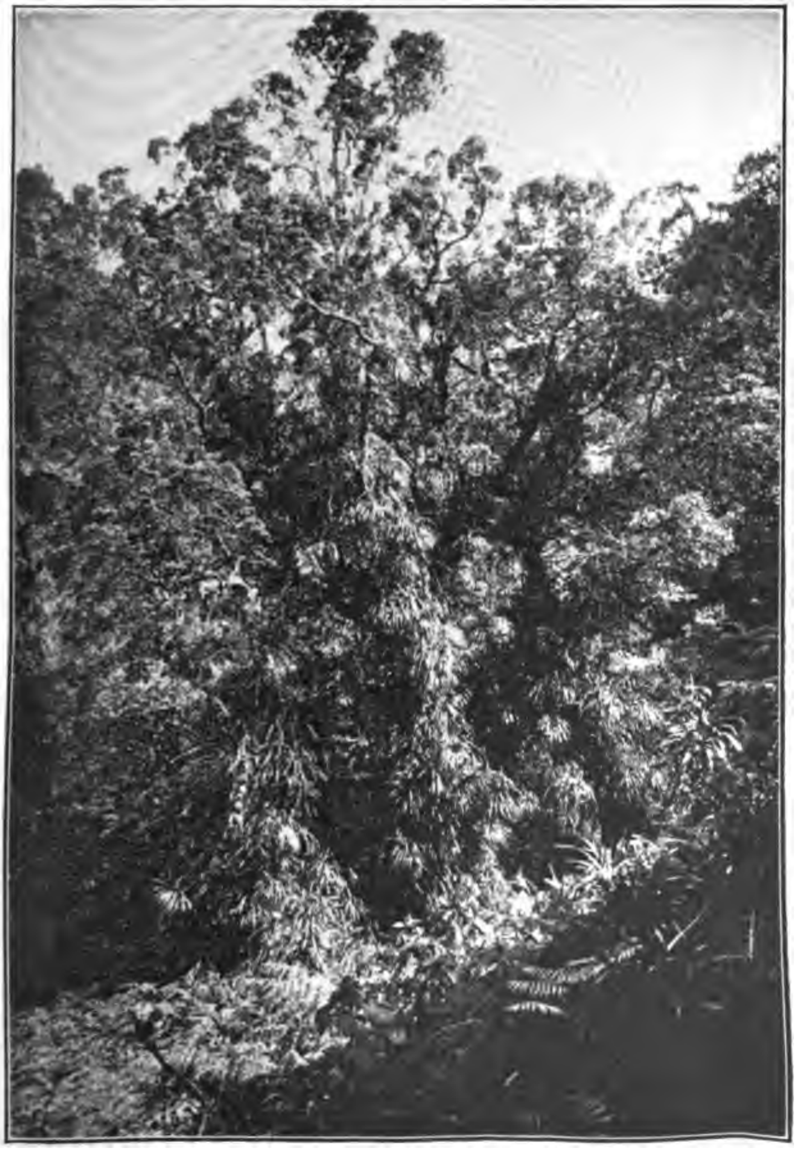


Plate 2. Ie-ie Vine on Ohia Lehua Tree.

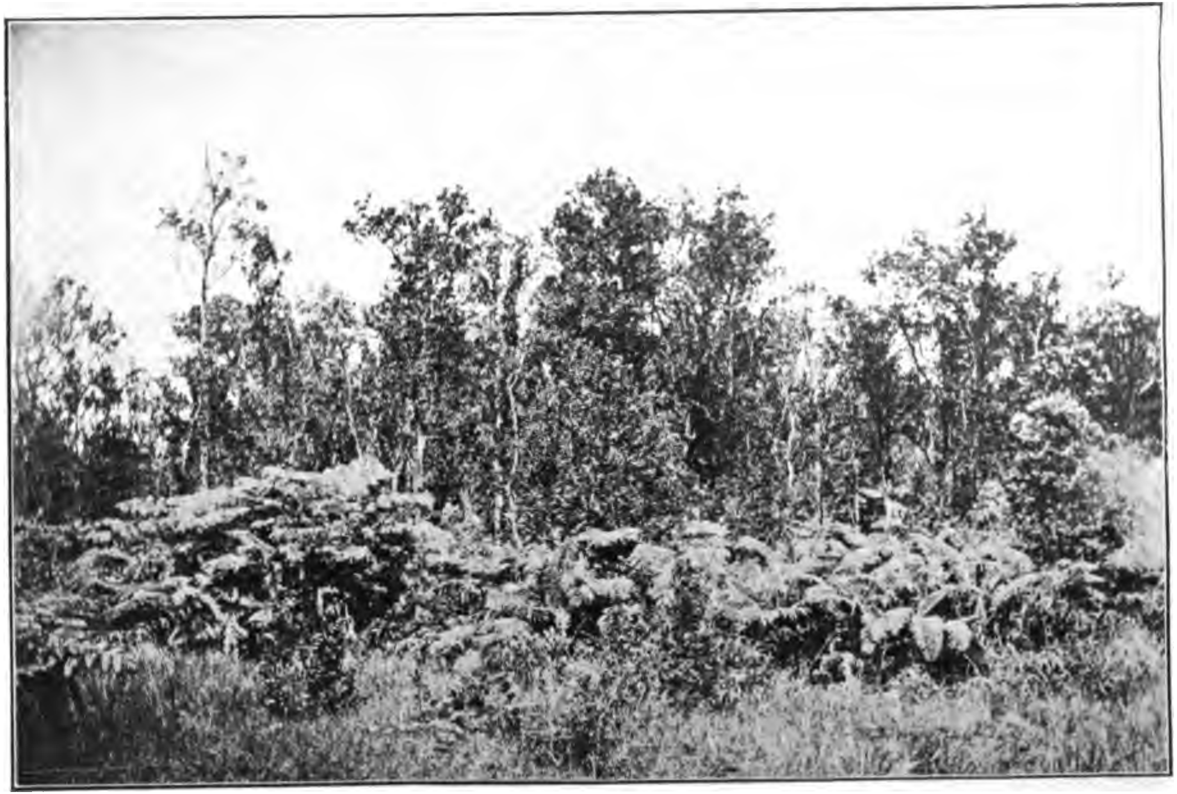


Plate 3. The Upper Transition Zone. A Typical View.

The Oahu Water Sheds and Their Relation to the Water Supply of the Honolulu and Ewa Basins.

As to the Oahu water sheds, more can be said as to what has *not* been done than otherwise, when it comes to their protection and conservation for water supply. Take the Waianae mountains for instance, their present condition and what they were years ago when the forest extended down the slopes of the valleys and ridges adjacent to the Waialua plains.

A similar condition exists and tends to become worse on the slopes of the Koolau range, the backbone of Oahu, from the forest areas of which so much artesian water is drawn for agriculture and city uses. What do we find today on these slopes as protective cover in place of the indigenous vegetation so necessary for our important water sheds? Hilo grass and scrub guava is practically all that remains of what was once a valuable adjunct to the virgin forests which conserve our water supply. Even these latter, excepting perhaps sections on the western half of the range, are daily suffering from the hands of man.

Fortunately cattle are practically excluded from the forested slopes in the Ewa District, and so far goats are not much in evidence. But what do we find in the way of forest protection? The water sheds above the City of Honolulu, from Moanalua to Waialae, although mostly Government land are not yet even included in a forest reserve, anl much less are they protected (with exception of portions of upper Nuuanu and Makiki valleys) by either the Government or private owners. So-called trails are being cut out of the face of the steep declivities on the mountains for the pleasure of those inclined to tramp, but outside of such pleasures no thought is taken of the forest ridges and wooded gorges which are simply allowed to take care ot themselves.

As a result of the trails cut by pleasure seekers, and of the depredations committed by those apparently ignorant of the peculiarities of our forest growths and the disaster which follows interference with them by man or beast, we find that eroded slopes caused by land slides are fast taking the place of what not so long ago were ideal conditions for conserving the precipitation. It goes without saying that the construction and further maintenance of trails on the steep sides of these mountain areas should be forbidden. Those pleasure bent, if allowed to trespass at all in our water sheds, should be altogether confined to the ridges where ran the ancient trails of the natives in olden days.

What are we to expect of Nature when man so wilfully, or is it ignorantly, defies and interferes with her course, especially when as in this particular instance the matter is of paramount importance to the City of Honolulu and its environs? What are we going to do in the very near future for a normal water supply if such lack of foresight on the part of the Government and of its citizens continues? Are we to trust to Providence in this as in other things?

It is quite certain that with the continued dying back of what little indigenous forest remains on the mountains back of Honolulu, and with the worse conditions of erosion which are taking place, the "run-off" from precipitation will be more than is now bargained for. In such case what is going to feed the springs and artesian wells upon which we absolutely depend for a normal supply of water? Even now the slightest appearance of dry weather indicates a great falling off in the water supply and this is immediately followed by a threatened curtailment for the time being of water rights.

If the agriculturists on this and the other islands are dependent on water for irrigation purposes, as they surely are, then it behooves them systematically to protect the forest and prevent disturbance of the conditions which conserve such supplies.

If the people of Honolulu desire to be assured of a constant future supply of water for domestic and other uses then similar protection must be enforced as to the mountains back of this city.

That this is by no means too highly colored a picture is proved by the following official figures, compiled by the Territorial Department of Public Works:

"It is estimated that about 350,000,000 gallons of water are delivered daily from all the artesian waters on Oahu, making an annual consumption of about 127,000,000,000 gallons.

"The annual consumption of artesian water between Fort Shafter and Diamond Head (Honolulu) from flowing and pumped wells is more or less 12,700,000,000 gallons, the daily consumption being about 35,000,000 gallons. We believe the amount of water actually leaving the artesian basin is more than this, owing to leakage through defective casing, etc.

"It is almost impossible at the present time to give anywhere near approximate figures on the average annual consumption of water as it is only recently that stream measurements have been taken up by the Hydrographic Survey. The Nuuanu dam, with the spring water used by the Water Works, probably amounts to about 1,450,000,000 gallons annually or 4,000,000 gallons per day. As a very rough estimate, the springs that are delivering water at the surface of the ground, may be placed at about 80,000,000 gallons per day, or 29,000,000,000 gallons per year. The flowing streams, are of course, also great sources of water supply. In accounting for the distribution of the rainfall, however, the underground springs which show themselves at the sea, and the evaporation, must be taken into consideration.

"As to the levels in artesian wells, about 1889 there was a drought, in which the artesian wells fell about 2½ feet. The following season there were heavy rains and the wells in Honolulu again rose to the 42½ ft. level. There have been no available records showing the exact height fifteen years ago, but from our knowledge of conditions of the wells at that time, we place it at about 38 feet.

"Ten years ago the maximum was 34.50 feet, the minimum 32.55, and the average 33.62.

"In 1908, say five years ago, the maximum was 31.81, the minimum 30.41, average 30.74.

"The lowest during the present year has been 28.25. In 1910 the level fell to 29.5 feet then rose during the winter season to 32.5 feet, giving us a total fall of over 4 feet. The recent rains have caused the wells in Honolulu to rise a little. Under normal conditions, we will get a seasonable rise of 1½ to 2 feet. This year's level is the lowest on record.

"It has been estimated that there annually falls on the Island of Oahu, which is roughly 600 square miles in area, enough rain to cover the island to a depth of five feet. Of the total precipitation it is estimated that there reaches the sea, or is lost through evaporation, the equivalent of a depth of 3¾ feet, leaving 1¼ feet of water over the 600 square miles to be the flow of the artesian wells and surface springs together."

With so large a percentage of the water coming to the surface in this way, under conditions where it can at least in part be controlled, the need is brought home of enforcing greater care than is now used in looking after this source of supply. Any one who knows anything at all about artesian wells in Hawaii, knows that frightful waste of water is constantly going on. It has been stated that the waste alone from uncapped artesian wells in the Honolulu basin amounts to 10,000,000 gallons of water per day. This water, now permitted to flow away to the ocean, might be stored for future use. In other ways, too, reasonable measures of economy as to the use of water are not now enforced as they should be. At present there appears to be no legislation under which abuses of this kind can be checked.

We have reached a stage of economic development in this Territory when we can no longer afford to allow such reckless and unwarranted carelessness. Water itself, as well as the forest that clothes the catchment areas, must be conserved, and what is more, action must be taken at once. The people of this island face a serious condition, one that can no longer brook delay.

The Need for Hydrographic Investigations in Conjunction With Systematic Forest Work in Hawaii.

Since writing the main portion of this paper the author has received a communication from G. K. Larrison, the local district engineer of the Hydrographic Service of the United States Geological Survey, from which the following is quoted relative to Hawaiian forest conditions and their relation to the hydrographic work which he is at present conducting and which he is desirous of extending:

"The direct and beneficial relation of forest cover to surface, stream and underground water regulation has been so thoroughly demonstrated and widely accepted by the world's water users that it may seem superfluous to invite attention to this relation again. However, the writer has observed an atmosphere of indifference on this subject in the Hawaiian Islands, which is all the more remarkable, because the supply and regulation of fresh water is, by far, the most important factor in the material life and development of Hawaii.

"The Hawaiian Islands are primarily agricultural, and for the greater part dependent on irrigation. While the rainfall is heavy, the catchment areas are comparatively small, the stream gradients very high, and the run-off from deforested and barren regions very rapid, with resulting heavy erosion and damage to agricultural lands and property. Further, there are very few natural storage sites in the Territory, and the run-off of barren regions may be likened to the run-off from a roof without gutters or rainspouts. In a great many locations porous or fissured conditions of the drainage areas result in a light surface run-off, and a heavy absorption of the rainfall. This water may sometimes be picked up by water tunnels or wells, but as a rule it appears in springs near or below sea level. The comparative cost of irrigating by pumping against the cost of surface gravity supplies is too well known to be discussed here. With the intermittent rainfall of the Territory, without regulation of some kind, the resultant run-off of surface streams would consist of short periods of high erosive and destructive floods followed by long periods of drought. Underground supplies would be similarly affected to a less degree.

"There is but one way by which Hawaiian streams may be economically regulated, and that is by retaining or developing a heavy blanket of forest cover over as much of the streams' catchment areas as may be consistent with the demand for water from these areas. The heaviest rainfall is, with few exceptions, above the levels at which agriculture is carried on and it is at these upper levels that the heaviest forest cover is needed as a water supply regulator. This spongelike cover receives and retains the rainfall, and feeds it gradually to the surface and underground water sources, serving as a regulator to decrease floods and to increase dry season discharge.

"The United States Geological Survey in collaboration with the National Bureau of Forestry, is now making careful and detailed experiments in the White Mountains of New Hampshire on the effect of deforestation and reforestation in its relation to surface stream regulation. While these experiments have not been completed, the results so far have proved conclusively that forest cover is a most important factor in the regulation of stream run-off. In the Hawaiian Islands and under tropical conditions, the forest cover is much more dense, and the beneficial or destructive effects of forest cover or the lack of it is much greater than in the White Mountains.

"The Territory of Hawaii, has, since 1910 maintained a hydrographic survey in cooperation with the United States Geological Survey. Limited funds have restricted operations to low level accessible localities with insufficient and temporary equipment. The 1911 and 1912 reports of this Survey are now being prepared, and should be given to the public within the next few months. These data will give the daily, monthly, and annual discharge of such streams as have been under investigation, and should furnish abundant proof of the necessity of forest cover as a stream discharge regulator. These reports will also show the amount of water that is being utilized, and the amount being wasted at a number of localities. In a number of cases seepage loss of irrigation ditches is also given.

"It is estimated that, during the drought of the past year on Kauai, enough water was wasted through lack of proper regulations to have increased the value of the sugar output of that island by more than one million dollars.

"From rainfall records available it is believed that sufficient rainfall is precipitated on the Hawaiian Islands to supply all possible needs, if the forests are properly maintained to regulate the run-off of this rainfall.

"The forestry and hydrographic operations are so closely related that the two services should be maintained in the closest possible form of cooperation.

"The development and conservation of Hawaii's water resources demand the following operations:

1. The maintenance of the forests over the heavy rainfall catchment areas to regulate streams and to prevent erosion.
2. The construction and maintenance of stream discharge measuring stations at points at which water supplies may be diverted for irrigation, city supply, power or other purposes. This means that these stations should be installed at points now inaccessible by most of the roads and trails, and that clock registers, which give continuous records of stream fluctuations, should be installed. Trails should also be built in order that the stations are accessible at all times, and cable or foot bridges should be constructed for flood measurements.
3. Climatological and meteorological stations should be constructed and maintained at different elevations in the rainfall and forest cover areas to measure the rainfall, evaporation, temperature, mud, sunshine, etc. These will also require the construction of many miles of trails.
4. After the surface water investigation is well under way an investigation of underground water resources should be made."

It will be made apparent from the above communication that the Hydrographic work and that of Forestry as already organized under the Division of Forestry of the Board of Agriculture and Forestry are closely associated, and should, as Mr. Larrison states, be maintained in the closest possible form of cooperation. It is believed that such cooperation as will produce the best practical results would be the creation of a Division of Hydrography under the Board of Agriculture and Forestry. This Division, if created, should consist of the present Hawaii District organization of the Water Resources Branch of the U. S. Geological Survey, in so far as the expenditure of the Territorial appropriation or allotment for this purpose is concerned. This organization is now indirectly reporting to the Department of Public Works.

This arrangement would also eliminate the additional expense of maintaining separate offices, as is now being done by the Hydrographic Survey, and would keep the Divisions of Forestry and Hydrography directly in touch with each other, and under one administrative head.

Additional reasons why the forestry and hydrographic operations in the Territory should be maintained in the closest possible cooperation are:

(1) The data collected by the hydrographic survey show directly the effects of forestry operations.

(2) In the routine field work of each service there is much work that will be duplicated by employees of both services, if it is not done in cooperation. The larger part of the time of field men of either service is consumed in traveling. A considerable portion of the field work done by the hydrographic service consists of stream and rain gage reading which requires that both classes of stations shall be visited at regular intervals. This duty does not require the services of an especially trained man, and a large part of this work could be done, and on the mainland is done, by forest rangers. On the other hand field men of the hydrographic service could, in the rounds of their duties, assist in exterminating wild cattle and goats, inspect fences, report depredations, fires, etc. It is believed that the cooperation of the two services would eliminate the cost of at least one field assistant or ranger in each island.

Indigenous Forests in Hawaii Not Essentially Needed for Conservation Purposes.

Of these there are several important areas, notably among which are those of the lower forest zone of Puna and certain sections of Kau and Kona, all on the Island of Hawaii. Of these in particular a word may be said and will suffice for a few similar areas in certain other districts or sections on other Islands.

It has been contended that our indigenous forests not essentially needed for water conservation, might well be used for other purposes, such as agriculture, lumbering, etc. This is quite true insofar as agriculture is concerned, provided that these areas after being cleared are found to contain soil in such chemical condition as will permit of intensive cultivation. This condition can better be ascertained and a policy arrived at as to whether it is right or wrong to clear off these forests, by first opening up an experimental area and testing the cultivable conditions of the soil.

To have done this on portions of the upper Olaa lands would have decided the question as to their adaptability for growing coffee. It is well known that after sacrificing thousands upon thousands of indigenous forest trees in the upper Olaa section it was found that the land was not suitable for the crops intended to be placed thereon by the homesteaders. Had the Government first experimented with the upper Olaa lands and found out that they could not be made of good economic use for coffee, not only would very many thousands of dollars have been saved to the many homesteaders who took up the lands in large areas, but tens of thousands of trees might have been spared the axe or been left to die of themselves because of the disturbance to their natural surroundings.

Fortunately for some of the homesteaders a corporation undertook, also at some loss to itself, as well as to those who planted these upper forest lands, to grow sugar cane on some of the areas cleared. This Company may, later on, by adapting certain varieties of cane to the land, redeem much which has been so far apparently wasted. Should success attain the efforts of these planters an unnecessary loss of sections of a large forest area will have been averted. Today may be seen in these upper areas thousands of acres, of what 15 years or so ago was an impenetrable forest, now covered with dead or dying trees and a thick growth of Hilo grass.

As to the lumbering proposition, it may be said that although heroic efforts have been put forth to make it pay, it has so far failed. This is perfectly natural in view of the fact that forests on these islands adaptable to the full growth of mar-

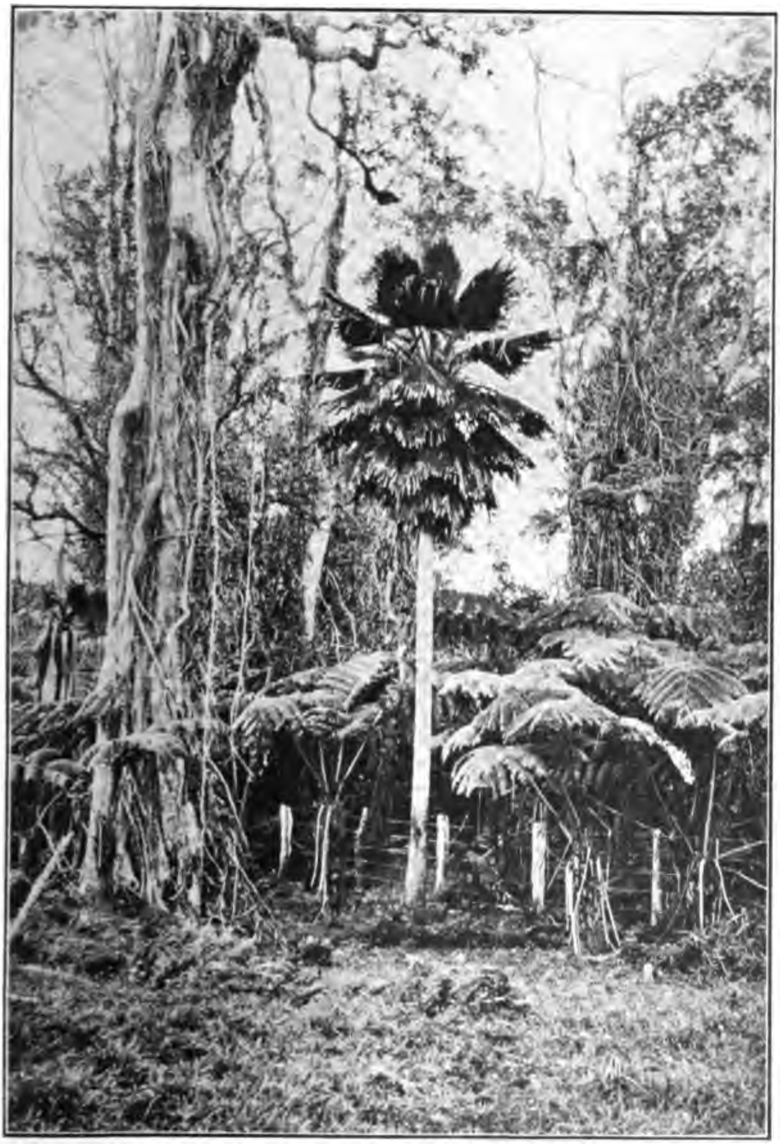


Plate 4. Where the Forest Gives Place to Grazing Land. A Forest Fence.

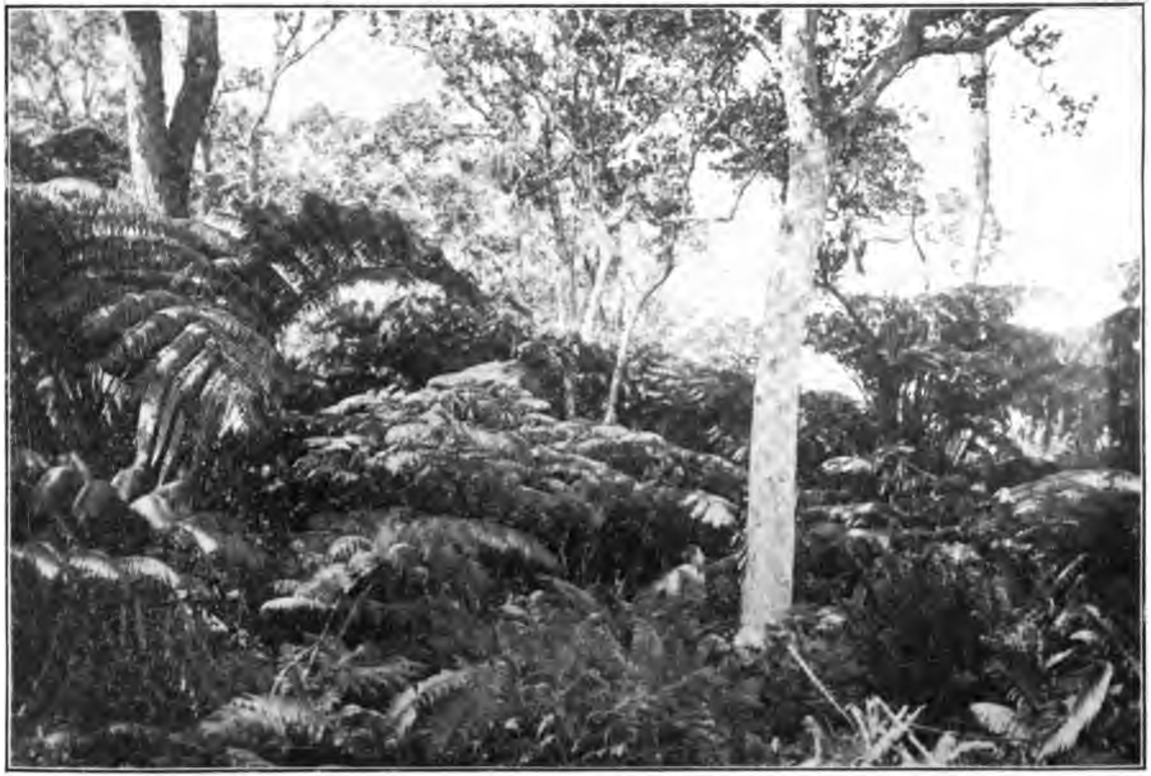


Plate 5. **Fern Undergrowth in the Hawaiian Forest.**

ketable lumber are extremely limited. The head of a lumber concern on the Coast once told me that he would hesitate to tackle any lumbering proposition on such comparatively small forest areas as we have in this Territory. The clear marketable lumber would be so limited in quantity that it would and could not pay. What has been done thus far on these lines has caused but little harm and it is hardly likely that further operations will be undertaken for a long while to come, if ever, unless it be by the saw mills now in Puna which still have limited areas of forest trees at their command.

I have in the previous section referred to the protective effect which intermediate or adjacent forest cover has on the water forests. Much more might also be said as to the modification of climate and rainfall which wholesale denudation of indigenous forest areas, such as those existing in the upper sections of Puna, Kau and Kona might eventually bring about. It is not only the large agriculturists who suffer from a lack of water supply. The smaller farmers, the graziers and residents generally are all more or less effected when such modifications of climate take place as bring about long and protracted droughts in certain sections or districts where there are no springs or running streams.

It would be well to study the reasons for such protracted droughts in sections where in old days these were never known. One certain conclusion, however, is apparent and that is, that the less we disturb natural forest conditions the better. When such disturbance appears necessary for the purposes of agriculture, experimental work extending over a reasonable period should first be undertaken, lest there result an altogether unnecessary destruction of forest growth and a further disturbance of climatic conditions. Surely there are sufficient cultivable and grazing lands for all without our taking such chances as the jeopardizing of our sources of water supply or changing our climatic conditions.

Forests Intended for Purely Economic Uses.

Of these there are practically none in this Territory beyond the small areas which have been planted in recent years. The fuel so necessary for our plantation laborers and other country residents has been mostly derived from these planted stands, or where no such plantings existed, from wild guava or other adjacent indigenous forest areas.

The old time practice of denuding the native forest areas in proximity to sugar mills, in order to secure fuel for the factories, has practically ceased, but there are many sections on some of the islands where the native forests are still used as a source of fuel supplies, regardless of the disturbance and subsequent harm it does to them.

The modern practice of planting, with introduced trees for fuel and fence post purposes, areas in close proximity to agricultural and grazing estates is to be highly commended. Much has been done in such work by private individuals or corporations, as well as under the auspices of the Board of Agriculture and Forestry. The time is past for our indigenous forests to be used for such wholesale slaughter as once prevailed. Local agriculturists and others are now alive to the fact that it is far more reasonable, and better for their own interests, to plant bare areas with large copses of Eucalyptus and other quick growing and fuel-producing timber trees, rather than to make further unwarranted onslaughts on the native forests.

For plantings in copses, wind breaks and fence rows such introduced trees as the Silk Oak, various species of Eucalyptus and many others are admirably adapted in this tropical climate. The practice however of reforesting or regenerating our indigenous forests with such trees as these is not to be recommended. Their habits and our requirements from such forests are inimical. What we require in forests intended for water conservation, or in those which are adjacent and contributary to them, are plantings, when necessary, of either some of our quick growing indigenous trees, such as Koa, or else of other trees which are closely associated allies in other tropical countries, which will admit of a thick, indigenous forest undergrowth to cover and protect the soil from erosion, as well as to retain the free percolating qualities which the constant moisture under such conditions brings about.

Introduced trees from temperate climates will not admit of such qualities and even those from tropical countries unless carefully selected are liable to be worse than useless. As far as Eucalyptus are concerned they are as previously stated, admirable for certain purposes but not for those of water conservation. Their roots are great feeders of moisture and but little undergrowth will mature where numbers of these are planted. Neither of these characters are suitable for the special conditions required in indigenous forest areas, and the practice of using them for such purpose should, if possible be deprecated.

Forest Plantings on Areas Above the Wet Forest Zones on Certain Islands.

Here we have an opportunity of testing what such trees as the Conifers may do in reclaiming areas which have never to our knowledge been under forest cover. The altitude from 6,000 feet upwards, and the consequent climatic conditions obtainable at these high elevations, make it quite possible to have some of our upper mountain slopes on Haleakala, Mauna Kea and Mauna Loa planted with species of Pines, etc., which are so admirably suited for lumbering purposes in other countries.

There is no known reason why some of the Conifers which attain such size and height in Southern California and Mexico could not be made to thrive at those very high altitudes, provided that nurseries were started and maintained and the plantings conducted under systematic supervision. It is to be hoped that the finances of the Board of Agriculture and Forestry will be such in the near future as will admit of the establishment of several of these nurseries on the mountains named. This could no doubt be undertaken in cooperation with some of the adjacent graziers or large land owners. The work of these high altitude stations should not be confined to the growing of introduced pines, etc. alone, but also should include the raising of many of our valuable high elevation indigenous trees. Such stations should be convenient to both upper indigenous forests and also to the unforested areas intended to be planted on the mountain slopes.

Appended to this paper is a list by Mr. J. F. Rock, Consulting Botanist of the Board of Agriculture and Forestry, giving the scientific names of certain quick growing exotic trees from other tropical climates, all of which he suggests may be of use in reforesting areas in our wet forest zones.

Besides being indebted to Mr. Rock for the compilation of the list above referred to, I have also to thank the Department of Public Works, the local branch of the U. S. Hydrographic Service, Mr. Ralph S. Hosmer, the Territorial Forester and Dr. H. L. Lyon of the H. S. P. A. Experimental Station for data besides much valuable information and assistance.

LIST OF TREE-SEEDS ADAPTABLE FOR PLANTING IN HAWAIIAN FORESTS, WITH ESPECIAL ADAPTATION TO ALTITUDE, CLIMATE AND SOIL CONDITIONS.

(Victoria, Kamerun, Africa)

African species adapted for the lower rain forest zone in the Hawaiian Islands.

FAM. MYRISTICACEAE.

Coelocaryon Preussii.
Staudtia kamerunensis.

FAM. LEGUMINOSAE.

Cassia Mannii. (Lower forest zone, rain forest 1500 feet elev.).
Afzelia africana. (Lower forest zone, rain forest 1500 feet elev.).
Erythrina excelsa. (Lower forest zone, rain forest 1500 feet elev.).

FAM. GUTTIFERAE.

Mammea ebboro.

FAM. BURSERACEAE.

Canarium auriculatum.

FAM. LILIACEAE.

Dracaena kamerunensis.
Dracaena Deisteliana. (Elev. 4500-5000 feet).

FAM. RUTACEAE.

Clausena anisata. (Rain forest 2400-3000 feet).

FAM. EUPHORBIACEAE.

Macaranga Preussii.
Treculia africana.

FAM. ARALIACEAE.

Polyscias Preussii.
Schefflera Barteri. (1500 feet elev.).
Schefflera Mannii.

FAM. LEGUMINOSAE.

Albizzia adiantophylla.
Erythrina lanata.

Sokode District, Togo, West Africa

Limonia Warneckei.
Diospyros mespiliformis.
Strophantus sarmentosus. } (Beautiful shade trees of the lower rain forests used for reforesting).
Strophantus hispidus.

German East Africa.

Amani, East Usambara. (2800 feet elev.)

Allanblackia Stuhlmannii.
Dracaena papahu.
Morinda asteroscepe.
Sapium Abyssinicum.

Especially noteworthy are the following trees:

Anthocleista orientalis. (Native name *mbogo*).
Strombosia Scheffleri.

FAM. LEGUMINOSAE.

Schefflerodendron usambarense.
Englerodendron usambarense.
Pterocarpus Holtzii.
Milletia ferruginea.

FAM. MELIANTHACEAE.

Bersama usambarensis.

FAM. EUPHORBIACEAE.

Crotogynopsis usambarica.

Cape Town, South Africa

The following trees are very common and form the major part of the forests of the table mountain.

FAM. OLEACEAE.

Olea laurifolia.

FAM. APOCYNACEAE.

Gonioma Kamassi.

FAM. CONIFERAE.

Podocarpus Thunbergii. (Common name Yellow wood).

Central American Trees of the Rain Forest Type.

Cuban rain forests.

Swietenia Mahagoni.
Cedrela odorata. (The Spanish Cedar. elev. 2000 feet).
Hibiscus elatus. (Dense rain forest).
Calophyllum calaba.
Ochroma lagopus.
Genipa americana.

Jamaica.

Dense tropical rain forests.

Ceiba pentandra=Eriodendron anfractuosum.
Podocarpus Urbanii. (Well adapted for the rain forests of the higher elevation).

Santo Domingo.

Guaiacum officinale. (Lignum vitae).
Zanthoxylum flavum or satin wood.

Porto Rico.

Coccoloba macrophylla. (2000 feet elev. rain forest).
Dacryodes hexandra. (Native name tabanuco tree one of the most common forest trees reproducing very freely, growing in the U. S. Luquillo National Forest).

Bucida capitata.
Andira inermis.
Ternstroemia luquillensis.
Hura crepitans.
Mammea americana.

Orizaba, Mexico.

Quercus polymorpha.
Quercus tomentosa.
Quercus jalapensis.
Quercus calophylla.
Quercus galeottii. (4000-5000 feet and higher).
Quercus germana.
Dendropanax arboreum.
Banara mexicana.
Platanus mexicanus. (Along stream beds, 4000-5000 feet).

Yucatan.

Inga xylocarpa. (Most common tropical rain forest tree).

Guatemalan Rain Forests.

Haematoxylon campechiana.
Liquidambar styraciflua. (2400-5700 feet).
Perymenium Tuerckheimii. (Native name *Taxico* tree, elev. 2100-5400 feet, in tropical and subtropical rain forests.

Mention may be made of the following trees which may be obtained from **Buitenzorg, Java.**

Sterculia spectabilis.
Dysoxylum mollissimum.
Vitex timorensis.
Vitex leucoxylon.
Schizolobium excelsum.

Of value for the Hawaiian forests may also be the introduction of some of the **Fijian Conifers.**

Dammara vitiensis. (Native name *Dakua* tree, adapted for the more mixed forest).
Podocarpus vitiensis. (Native name *Kau solo,* one of the finest Conifers found on Viti Levu).
Dacrydium elatum. (Native name *Leweninini,* a medium sized tree found in mixed forests; adapts itself to almost any environment. Found in Fiji from the sea shore to the highest peaks, (4000 ft.).

Plate 6. **An Irrigation Ditch in the Forest.**

Division of Forestry.

Report of the Superintendent of Forestry.

Honolulu, Hawaii, December 31, 1912.

The Board of Commissioners of
Agriculture and Forestry,
Honolulu, Hawaii.

GENTLEMEN:—I have the honor to submit as follows the report of the Division of Forestry for the calendar years 1911 and 1912.

THE REASON FOR PRACTICING FORESTRY IN HAWAII.

"Save the forests—Store the floods." To the people of Hawaii this motto of the National Irrigation Congress voices an imperative demand. Vitally important in the Western States, the conservation of water is also, and perhaps even in greater measure, required for this Territory. Water is a fundamental need everywhere. In Hawaii the foundations of the whole economic structure of the Territory rest on its wise and right use. Everything that tends to perpetuate or increase the local supply of water is of interest and moment.

One of the chief factors in maintaing an assured water supply is the forest. It needs no argument to prove this. The truth of the statement is self evident. But because this is so, the practice of forestry in Hawaii becomes an economic necessity. The object of this report is to sum up the reasons why the forest area of Hawaii must be protected and increased, and briefly to outline what has been accomplished during the past two years in this and the kindred lines of forest work now being carried on under the direction of the Territorial Government.

The way in which the native Hawaiian forest exerts its influence on water supply has so often been pointed out that it ought now pretty well to be understood. But with the added demands that each year's development makes on the sources of supply, the need becomes more apparent of husbanding this most important of our natural resources.

In Hawaii with its short, steep watersheds, the limited area of its catchment basins and the great and sudden fluctuations in rainfall, even in the supposedly wet districts, it is of paramount importance that a cover of vegetation be permanently maintained on the slopes of the mountains whence come the streams that feed the irrigation ditches. On the continuance in good condition of large tracts of forest depend the prosperity and well being of many people, for a body of forest reacts favorably on the region adjacent to it in many ways.

In our present state of knowledge we may not know just how this influence is exerted, nor how far reaching are its effects, as for example on local climate and on health. But it is the experience of mankind that a body of forest is a valuable asset, a heritage which ought not to be jeopardized through neglect or mismanagement.

The droughts of the past season bring home the vital connection that exists between water and the yield of the sugar plantations. How much more would serious deterioration of the forest spell a general diminution of prosperity. And yet that is just what is happening all over the Territory, in all the windward districts where the native wet forest is not being protected from trespass and kept free from injury by man, wild stock and the rank-growing introduced grasses and other weeds.

With the outlook for the future what it is in this Territory today, the time has unquestionably arrived when greater care must be given the forests. Fencing, the extermination of wild cattle and goats, the extension of the native forest cover, are all things that urgently call for prompt and energetic attention.

There has been enough and to spare of talk. What is demanded now is the means to carry into effect the plans which the Board of Agriculture has worked out for meeting the present needs. These plans have been developed in conjunction with the Hawaiian Sugar Planters' Association and will receive the support of that organization, but it is not enough for the corporations only to take a hand in this matter. The protection and right use of the native Hawaiian forest is an issue that concerns all the people of the Territory, large interests and small landholders alike, for everybody uses water. The need for water is a common need. A well kept forest cover on the watersheds is essential to an assured supply.

The means for doing what is required can be had by devoting to forest purposes, especially to forest protection, a portion of the revenues now derived from the water right leases and licenses in the existing forest reserves. Upwards of $67,000 per annum is now received by the Territory from this source· A part of this money ought to be reinvested in the forest as a revolving fund, which in the end would pay back the amount so invested, with good interest. I earnestly recommend that this matter be given serious consideration by the Commissioners.

During the past two years a large share of attention has been paid by the Division of Forestry to interesting corporations and individuals in tree planting, both through the giving of advice and by the supplying of actual plant material. This work is of much practical importance and should be continued, but for 1913 the forest needs of the Territory are first and essentially the better protection of the native forst. While there is yet time let us here in Hawaii "conserve the foundations of our prosperity."

SUMMARY.

During the past two years the activities of the Division of Forestry have followed in general the program laid down when forest work was systematically begun in this Territory ten years ago. Four new forest reserves have been added to the chain extending through the islands and three of the older reserves have been increased in area. Most of the necessary field work preliminary to the technical reservation of the remaining forest areas that it is proposed to add to the forest reserve system has been completed. Measures looking to the maintenance in good condition of the native forests, particularly those set apart as forest reserves, have been forwarded. Tree planting on government land and by private owners has received a decided impetus through the activities of this Division. The giving of advice on various forest matters has been continued and has met a hearty response from those benefitted. Additional information has been secured concerning the value locally of trees of economic importance new to the Territory. And through the forest fire service, protection has been afforded against that danger. Altogether the years 1911 and 1912 have seen a marked advance both in the status of forestry in Hawaii and in results actually accomplished.

The important thing now is to treat what has already been done merely as an incentive for better efforts in the future and to press on toward the goal of all forest work—the wise use of the forest for the continuing good of all the people.

STAFF.

During the past biennial period the staff of the Division of Forestry has consisted of the Superintendent of Forestry (Ralph S. Hosmer) and the Forest Nurseryman (David Haughs). Until September, 1911, Mr. Joseph F. Rock was also a member of the staff, under the title of Botanical Assistant. He was then transferred to the faculty of the College of Hawaii, but as an honorary officer of the Board his name is still carried on the rolls as Consulting Botanist.

Certain changes among the District Fire Wardens are indicated in a revised list of these volunteer officials of the Board that appears elsewhere in this volume.

APPROPRIATIONS.

For the past two years the expenses of the Board of Agriculture and Forestry have been met from the Conservation Fund. Of this the expenditures of the Division of Forestry were as follows:

Year.	Salaries and Pay Rolls.	Current Expenses.	Total.
1911	$9,765.05	$ 807.63	$10,572.68
1912	8,813.43	1,246.97	10,060.40

From special allotments there was also expended during these years for forest work:

Forest Planting, Pupukea, Oahu	$ 831.30
" " Kohala Mountain, Hawaii..	3,421.60
	$4,252.90

From the sale of Ohia timber, under a territorial license, in the Puna Forest Reserve, Hawaii, the sum of $2,955 was realized in June, 1911. This amount was set apart, under the law, as a special fund for forest work. In 1912 this money was transferred to the account of forest planting on Kohala Mountain.

At the close of 1912 there still remains available $4,402.25 for additional planting in this account.

As general realizations from the sale of seeds, plants, etc., and of dead wood from the Tantalus forest, there have been turned into the Territorial Treasury by the Division of Forestry the following amounts:

For the year 1911	$612.75
" " " 1912	295.40

FOREST RESERVES.

To those who have followed the earlier reports of this office, the reasons underlying the creation of forest reserves in Hawaii are an old story. But the need for forest protection and forest work remains and will always continue in Hawai to be a vital one.

Many of the great functions of the Government now go on so smoothly that we have ceased to think much about them, but nevertheless it is well for us that our fundamental rights are safeguarded.

In a somewhat similar way it must not be forgotten that agriculture cannot exist in these islands in a large way, without irri-

Plate 7. **Dense Forest on a Ridge in a Watershed.**

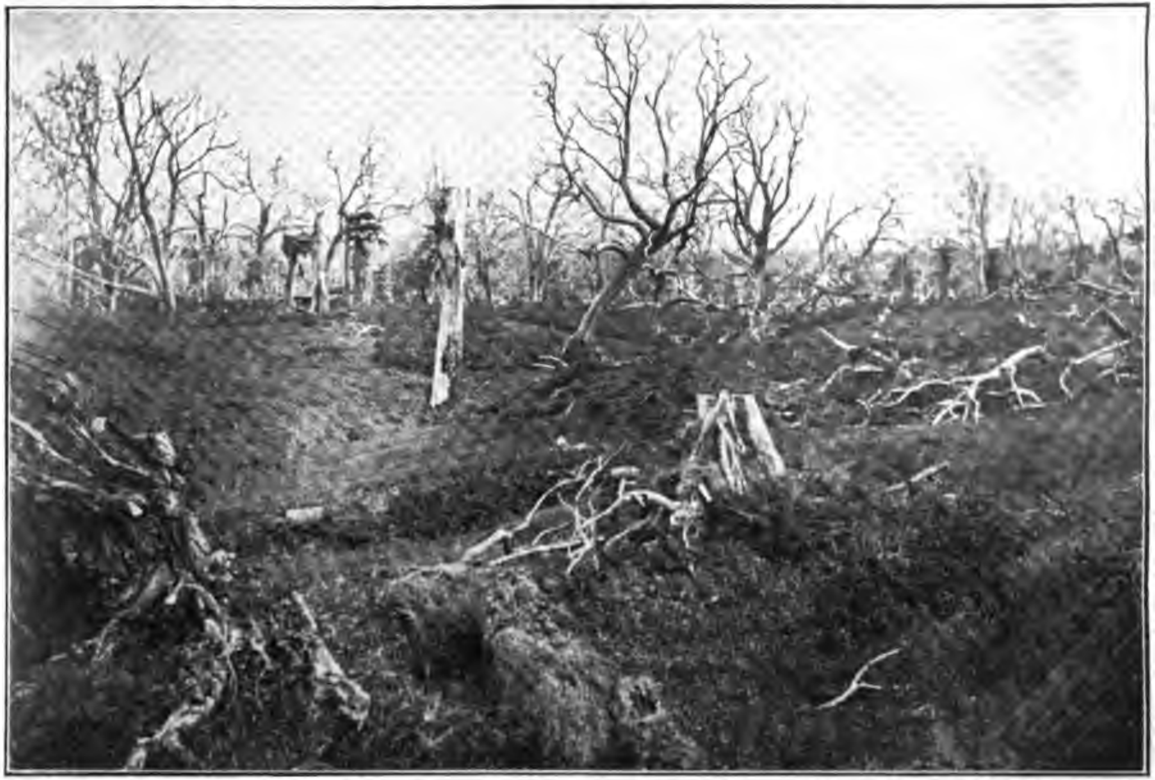


Plate 8. **A Hawaiian Forest After Fire and Grazing.**

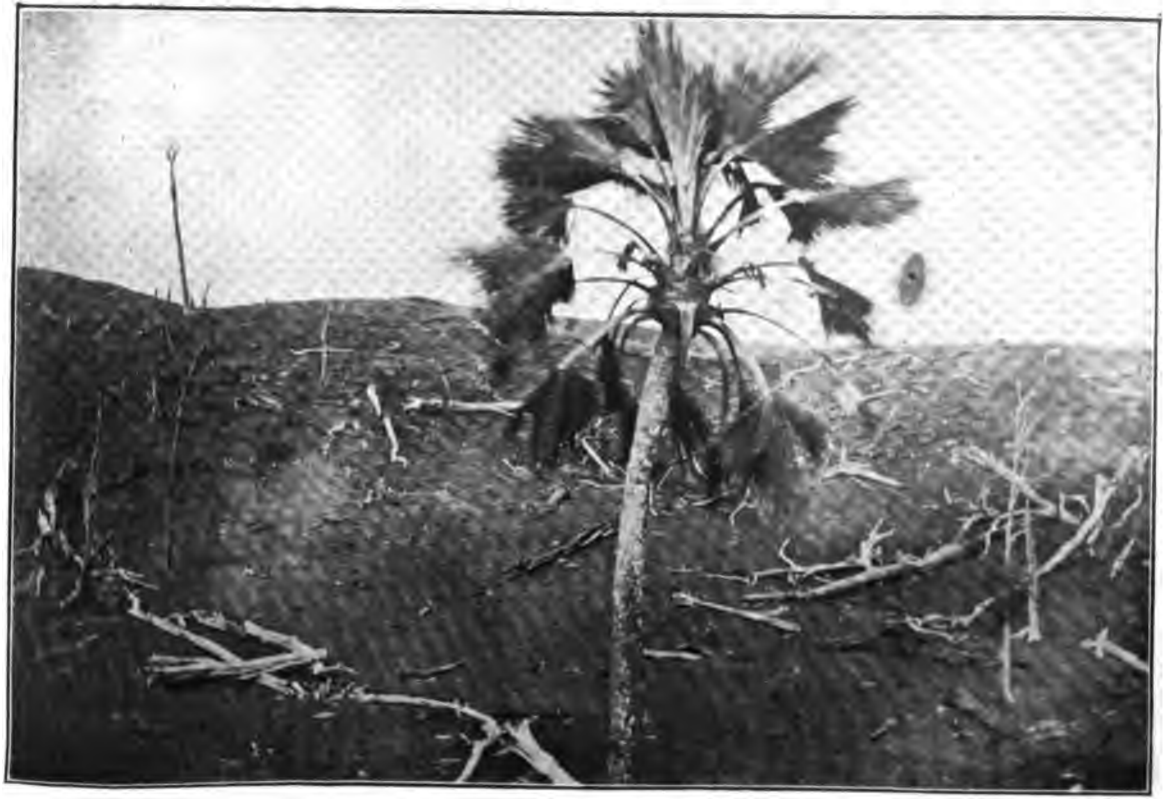


Plate 9. Remnants of the Past.
This palm normally is found only in the dense wet forests.

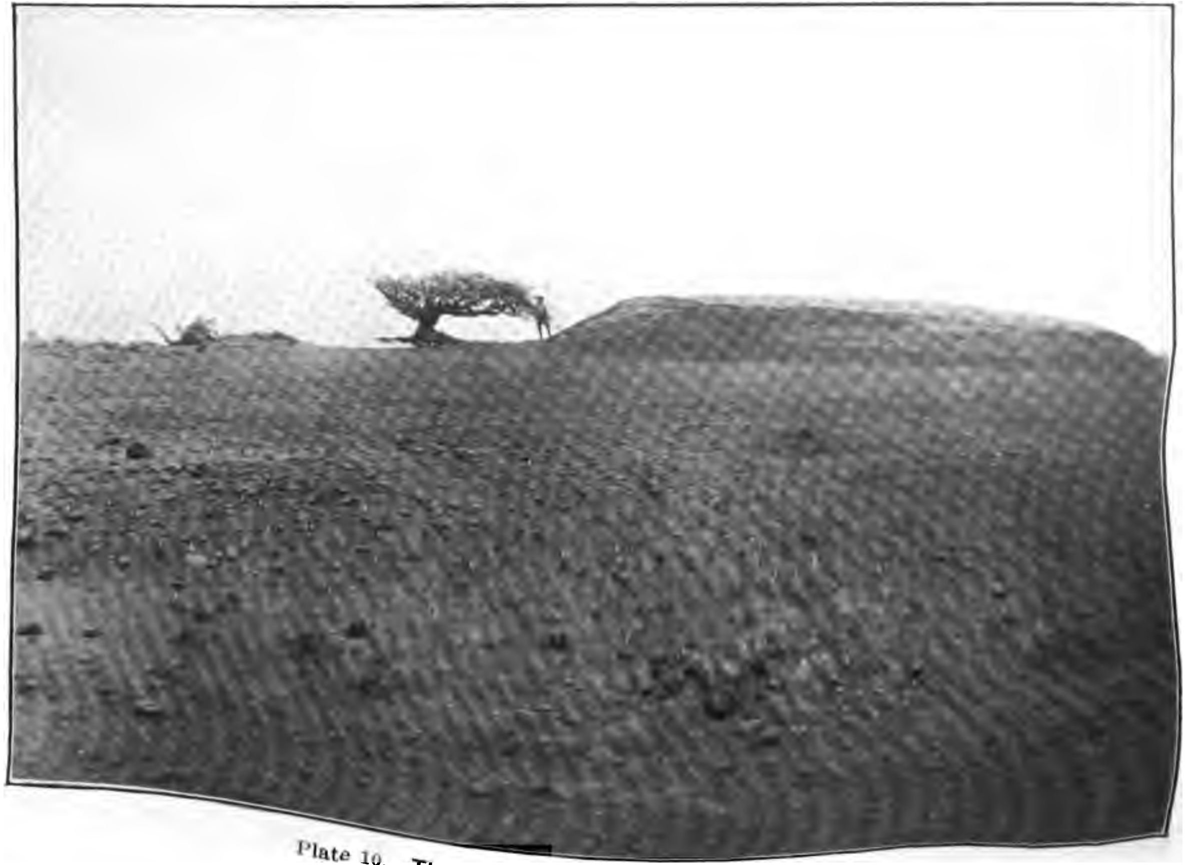


Plate 10. **The Ultimate Result of Forest Destruction.**
Two-thirds of the Island of Kahoolawe is like this.

gation. Under the natural conditions that obtain here—climatic, geologic, topographic—an assured supply of water cannot be relied on unless the catchment areas are kept clothed with vegetation. The native Hawaiian rain-forest is the ideal of the type of protection forest needed. It is a plant community that precisely fills man's needs for keeping conditions at the head waters of the streams as he desires them.

But owing to the extreme susceptibility of the Hawaiian forest to injury and to the rapidity with which it deteriorates when trouble gains a foothold, it is absolutely essential, in order to retain and perpetuate the conditions most favorable for water conservation, that the native forest receive adequate protection and care. This is the reason why forest reserves are created. The areas necessary to protect given streams are set apart that they may be managed to help secure for all time the largest possible flow in the streams or springs whose sources they surround. So too, with the artesian supply. Unless the catchment basins are protected, the flow in the wells below will fluctuate and eventually decrease.

By far the greater part of the native Hawaiian forests, especially in the districts on the windward sides of the several islands, are of value primarily on account of the water which can be got from them. As has often been said of these forests, *water,* not wood, is their important product. Their management must therefore be with reference to water. This means in practice that the water bearing forests should be treated strictly as "protection forests," from which men and animals alike are to be excluded. The continuation of primitive conditions is the ideal—the elimination of all sorts of trespass.

That we are yet very far, in Hawaii, from the realization of this ideal is unfortunately true. Technically, to be sure, forest reserves have been set apart on each of the larger islands. Practically, only a few of those created are receiving the care necessary to keep them in the condition in which they should be maintained for the good of all concerned. Through the co-operation of corporations and individuals much, of course, has been and is being done, in fencing, in protection, and in some cases in forest planting. But the need remains for more fences, for the complete eradication of wild cattle and goats and in some cases pigs from the reserves, for continuing protection from fire, and in many places for improving the forest cover and extending it, particularly in those forest reserves that are created essentially for water protection.

These are the needs of the present. They are needs that must be met. For unless the required protection is given, and that speedily, the native Hawaiian forest will recede and disappear just as surely as it has already gone in Hamakua, Hawaii, or as it is now going in North Kona.

The mere formal creation of forest reserves, the delimiting of boundaries and the coloring in of given areas on a map are of course only steps in the process of getting the forests under proper control. These are necessary steps and have to be gone through with, but the essential thing is protection—and the appointed time for securing protection is now.

The Board of Agriculture has detailed plans showing what ought to be done in the way of fencing and protection on each reserve. The practical requirement is for funds with which to get this work under way. As has already been pointed out, the reasonable solution of this problem is through the assignment to forest work of a portion of the revenues now received by the Territory from the leases and licenses of water rights in a number of the forest reserves. A percentage of this money ought to be devoted to the protection and improvement of the native forest on Government land. Every effort should be made to secure its use for this purpose.

NEW RESERVES.

During the past two years four new forest reserves were added to the list, making a total at the close of 1912 of 27 forest reserves that have formally been set apart. The new reserves are as follows:

South Kona—Kona and Kau, Hawaii. May 17, 1911. Total area, 36,952 acres; area of Government land 29,260 acres.

Puna—Puna, Hawaii. June 29, 1911. Area 19,850 acres, all Government land.

Molokai—Molokai. September 11, 1912. Total area, 44,674 acres; area of Government land, 13,268 acres.

Kula—Kula, Maui. September 11, 1912. Total area, 6,075 acres; area of Government land, 5,069 acres.

In February, 1911, the boundaries of two of the older reserves, West Maui and Kau, Hawaii, were modified and the areas somewhat increased. Similar action was taken in September, 1912, with regard to the Waianae kai Forest Reserve on Oahu, and through a land exchange on Kauai, 420 acres of forest in the Lihue-Koloa Forest Reserve were transferred from private to Government ownership.

At the close of 1912 there are twenty-seven forest reserves in the Territory of Hawaii with a total area of 683,101 acres, of which 454,810 acres, 67 per cent., is Government land. On following pages are tables giving in detailed form the statistics of each reserve.

Of the four new forest reserves, *Molokai* is essentially protection forest· *Puna* and *South Kona,* being in districts where there are no running streams, were set apart primarily because of the prospective value of the forest on them from a commercial standpoint.

Soon after the establishment of the Puna Forest Reserve a payment of $2955, made on behalf of the Hawaii Lumber Company for the right to cut Ohia timber, under an existing license, was received by the Division of Forestry. This money was set aside under the forest law (Chapter 28, Section 385, Revised Laws of Hawaii) as a special fund for conducting forest work. In that this payment was the first one to be made under this section of the law, it may be of interest to note it here. The money has been allotted for forest planting on the Island of Hawaii

Kula consists mainly of a portion of the upper slopes of Mt. Haleakala,. above the area of especial value for grazing. Like the Mauna Kea Forest Reserve on Hawaii, the object here is to keep under control of the Board of Agriculture and Forestry land now of but little value for any form of agriculture. with the expectation that in time considerable portions of it may be made to grow useful trees. Experimental work is constantly going on to find out what species of economic trees can be made to grow in various parts of the Territory. It is confidently expected that in the end one or more species will be found that will do well on the upper slopes of our higher mountains.

FOREST RESERVES, TERRITORY OF HAWAII. Arranged in Chronological Order.

No.	Name.	District.	Island.	Total Area Recommended to be Reserved.	Area Government Land	Area Private Land.	Date of Proclamation	Proclamation Signed by
				Acres.	Acres.	Acres.		
1	Kaipapau	Koolauloa	Oahu	913	913	......	Nov. 10, 1904	G. R. Carter
2	Hamakua Pali	Hamakua	Hawaii	18,940	16,333	2,607	Dec. 23, 1904	"
	Total for the year ending December 31, 1904			19,853	17,246	2,607		
3	Hilo	Hilo	Hawaii	110,000	60,223	49,777	July 24, 1905	A. L. C. Atkinson
4	Koolau, Maui	Koolau and Hamakualoa	Maui	42,969	30,230	12,739	Aug. 24, 1905	"
5	Halelea	Halelea	Kauai	37,500	10,990	26,510	Aug. 24, 1905	"
	Total for the year ending December 31, 1905			190,469	101,443	89,026		
6	Kealia	Puna	Kauai	9,935	7,385	2,550	Mar. 9, 1906	"
7	Ewa	Ewa, Waianae and Waialua	Oahu	28,550	5,151	23,399	Mar. 9, 1906	"
8	Honuaula	Kona	Hawaii	665	665	......	April 4, 1906	"
9	Kau	Kau	Hawaii	†66,066	59,811	6,255	Aug. 2, 1906	G. R. Carter
10	Waianae-kai	Waianae	Oahu	‡ 3,653	3,546	107	Sept. 7, 1906	"
11	Lualualei	Waianae	Oahu	3,743	3,743	......	Nov. 30, 1906	"
12	Hana	Hana	Maui	14,825	13,767	1,058	Nov. 30, 1906	"
	Total for the year ending December 31, 1906			127,437	94,068	33,369		
13	Na Pali-Kona	Na Pali and Kona	Kauai	60,540	40,650	19,890	June 12, 1907	A. L. C. Atkinson
	Total for the year ending December 31, 1907			60,540	40,650	19,890		
14	West Maui	Lahaina, Kaanapali and Wailuku	Maui	§44,482	19,147	25,335	April 21, 1908	W. F. Frear

15	Makawao......	Hamakuapoko	Maui	* 1,830	1,830	......	April 21, 1908	"
16	Waiaha Spring.	Kona	Hawaii	193	193	......	April 21, 1908	"
	Total for the year ending December 31, 1908.......			46,505	21,170	25,335		
17	Mauna Kea....	Hamakua	Hawaii	66,600	66,600	......	June 5, 1909	"
18	Waihou Spring.	Hamakuapoko	Maui	84	74	10	June 5, 1909	"
19	Lihue-Koloa....	Puna and Kona	Kauai	¶29,260	13,365	15,895	June 5, 1909	"
20	Moloaa........	Koolau	Kauai	5,670	3,615	2,055	June 5, 1909	"
	Total for the year ending December 31, 1909.......			101,614	83,654	17,960		
21	Pupukea.......	Koolauloa	Oahu	865	865	......	May. 10, 1910	E. A. Mott-Smith
22	Hauola........	Hamakua	Hawaii	7	7	......	June 13, 1910	W. F. Frear
23	Kahoolawe.....	County of Maui	Kah'lwe	28,260	28,260	......	Aug. 25, 1910	"
	Total for the year ending December 31, 1910.......			29,132	29,132	......		
24	South Kona....	Kona and Kau..............	Hawaii	36,952	29,260	7,692	May 17, 1911	"
25	Puna..........	Puna	Hawaii	19,850	19,850	......	June 29, 1911	"
	Total for the year ending December 31, 1911.......			56,802	49,110	7,692		
26	Molokai.......	Kona and Kau..............	Molokai	44,674	13,268	31,406	Sept. 11, 1912	"
27	Kula..........	Kula	Maui	6,075	5,069	1,006	Sept. 11, 1912	"
	Total for the year ending December 31, 1912......			50,749	18,337	32,412		
	Grand Total, December 31, 1912..		......	683,101	454,810 [67%]	228,291 [33%]		

† Boundary modified and area enlarged from 65,850 to 66,066 acres by proclamation of Gov. Frear, February 4, 1911
‡ " " " " " " 3,257 to 3,653 " " " " " " September 11, 1912.
§ " " " " " " 44,440 to 44,482 " " " " " " February 4, 1911
* " " " " " " 1,796 to 1,830 " " " " " " June 5, 1909
¶ By land exchange 420 acres transferred from private to government ownership.

FOREST RESERVES, TERRITORY OF HAWAII. Arranged by Islands and Counties.

No.	Name.	District	Island.	Total Area Recommended to be Reserved.	Area Government Land.	Area Private Land.	Date of Proclamation	Proclamation Signed by
			COUNTY OF KAUAI.					
				Acres.	Acres.	Acres.		
5	Halelea	Halelea	Kauai	37,500	10,990	26,510	Aug. 24, 1905	A. L. C. Atkinson
6	Kealia	Puna	Kauai	9,935	7,385	2,550	Mar. 9, 1906	"
13	Na Pali-Kona	Na Pali and Kona	Kauai	60,540	40,650	19,890	June 12, 1907	"
19	Lihue-Koloa	Puna and Kona	Kauai	¶29,260	13,365	15,895	June 5, 1909	W. F. Frear
20	Moloaa	Koolau	Kauai	5,670	3,615	2,055	June 5, 1909	"
	Total for Kauai			142,905	76,005	66,900		
			CITY AND COUNTY OF HONOLULU (OAHU).					
1	Kaipapau	Koolauloa	Oahu	913	913	......	Nov. 10, 1904	G. R. Carter
7	Ewa	Ewa, Waianae and Waialua	Oahu	28,550	5,151	23,399	Mar. 9, 1906	A. L. C. Atkinson
10	Waianae-kai	Waianae	Oahu	‡ 3,653	3,546	107	Sept. 7, 1906	G. R. Carter
11	Lualualei	Waianae	Oahu	3,743	3,743	......	Nov. 30, 1906	"
21	Pupukea	Koolauloa	Oahu	865	865	......	May 10, 1910	W. F. Frear
	Total for Oahu			37,724	14,218	23,506		
			COUNTY OF MAUI.					
4	Koolau, Maui	Koolau and Hamakualoa	Maui	42,969	30,230	12,739	Aug. 24, 1905	A. L. C. Atkinson
12	Hana	Hana	Maui	14,825	13,767	1,058	Nov. 30, 1906	G. R. Carter
14	West Maui	Lahaina, Kaanapali and Wailuku	Maui	§44,482	19,147	25,335	April 21, 1908	W. F. Frear
15	Makawao	Hamakuapoko	Maui	* 1,830	1,830	......	April 21, 1908	"

18	Waihou Spring	Hamakuapoko	Maui	84	74	10	June 5, 1909	"
23	Kahoolawe	County of Maui	Kah'lawe	28,260	28,260	......	Aug. 25, 1910	"
26	Molokai	County of Maui	Molokai	44,674	13,268	31,406	Sept. 11, 1912	"
27	Kula	Kula	Maui	6,075	5,069	1,006	Sept. 11, 1912	"
	Total for Maui			183,199	111,645	71,554		

COUNTY OF HAWAII.

2	Hamakua Pali	Hamakua	Hawaii	18,940	16,333	2,607	Dec. 23, 1904	G. R. Carter
3	Hilo	Hilo	Hawaii	110,000	60,223	49,777	July 24, 1905	A. L. C. Atkinson
8	Honuaula	Kona	Hawaii	665	665	......	April 4, 1906	"
9	Kau	Kau	Hawaii	†66,066	59,811	6,255	Aug. 2, 1906	G. R. Carter
16	Waiaha Spring	Kona	Hawaii	193	193	......	April 21, 1908	W. F. Frear
17	Mauna Kea	Hamakua	Hawaii	66,600	66,600	......	June 5, 1909	"
22	Hauola	Hamakua	Hawaii	7	7	......	June 13, 1910	E. A. Mott-Smith
24	South Kona	Kona and Kau	Hawaii	36,952	29,260	7,692	May 17, 1911	W. F. Frear
25	Puna	Puna	Hawaii	19,850	19,850	......	June 29, 1911	"
	Total for Hawaii			319,273	252,942	66,331		
	Grand Total, December 31, 1912			683,101	454,810 [67%]	228,291 [33%]		

¶ By land exchange 420 acres transferred from private to government ownership.
‡ Boundary modified and area enlarged from 3,257 to 3,653 acres by proclamation of Gov. Frear, September 11, 1912.
§ " " " " " " 44,440 to 44,482 " " " " " " February 4, 1911
* " " " " " " 1,796 to 1,830 " " " " " " June 5, 1909
† " " " " " " 65,850 to 66,066 " " " " " " February 4, 1911

PROPOSED FOREST RESERVES.

Reports recommending the creation of additional forest reserves on the Waianae Hills, Island of Oahu, are now in the hands of the Committee on Forestry. Other forest reserve projects on Oahu and Hawaii only wait the completion of the technical description by the Survey Department to be brought to the stage of final action.

Condemnation proceedings instituted by the Territorial Government for the acquisition of a portion of the land of Kehena 2 on the Kohala Mountain, Hawaii, which it is proposed be included in the Kohala Mountain Forest Reserve, were still pending at the end of the year.

Under the heading "Forest Planting" mention will be made of work in forest replacement carried on in two of the forest reserves.

FENCING FOREST RESERVE BOUNDARIES.

It is the policy of the Territory so far as possible to provide or the construction and maintenance of fences on forest reserve boundaries through clauses in the leases of adjoining government lands that are devoted to agriculture or grazing. Under such a requirement a fence was built in 1911 by the Princeville Plantation Company along a section of the boundary of the Halelea Forest Reserve above Hanalei, Kauai. The fence runs between the Kalihiwai and the Hanalei streams. While only a little over a mile long it shuts off and protects a very large area of the forest above. The fence itself is very substantially built and should stand for a considerable time with only such minor repairs as must always be given to any fence line in the woods. Special mention is made of it here because this fence was practically built voluntarily, the requirement that such a fence be built having been inserted in this lease at the suggestion of the officers of the Princeville Plantation Company. As will be recalled, similar co-operation has been shown in past years by a number of other corporations throughout the Territory.

Other localities where fence building is required on government land, along forest reserve boundaries, by government leases now in force are Kula, Maui, on lands leased to the Cornwell Ranch; Kapaa and Kamalomalo, Kauai, on lands above the Kealia Plantation; Waioli, Kauai, under a lease to C. B. Makee; East Ohia and Kahananui, Molokai, under leases respectively to A. Rodriguez and C. Kaanoi; and Humuula, Hawaii, under a lease to the Humuula Sheep Station.

Other leases call for the building of fences on forest reserve lines as soon as certain proposed forest reserves on Oahu shall have been officially set apart. While again, still other leases call for the up-keep of fences built, voluntarily or under lease requirements, in former years, on forest reserve boundaries on each of the larger islands of the group. In addition many miles of forest fence are voluntarily maintained by sugar plantation companies and ranches on forest reserve boundaries across Government lands, not to speak of forest fences wholly on privately owned lands.

An estimate recently made of forest fencing now in existence, required to be constructed under leases in force, and needing to be built for the better protection of the native forest, shows the following data, which while only pretending to be approximate, give a fairly good idea of the length of fencing required:—

	Government Lands. Miles.	Private Lands. Miles.
Existing forest fences	110.0	111.0
Fences required to be built under leases now in force	21.5	.....
Needed fencing	85.0	91.0
	216.5	202.0

When this needed additional fencing is all done and the fences so built and those now in existence are being properly cared for, the forests of Hawaii will be in vastly better condition than they are today. The particular forest need of the present year is to get this work started and under way.

KAHOOLAWE.

Perhaps at this point reference should be made to the reclamation of the Island of Kahoolawe.

This small island (28,260 acres) was, upon the expiration of a fifty-year lease, set apart in August, 1910, as a forest reserve. This action was taken at the suggestion of the Governor and was in accordance with a concurrent resolution passed by the Legislature at the session of 1909. The purpose of the action was to bring Kahoolawe under the control of the Department of the Territorial Government best fitted to handle the task of restoring to a condition where it would be of real value, an island that through continued over-stocking by cattle and sheep followed by the action of the elements, has been reduced in large part to an absolutely barren waste.

As it is now, somewhat over half of the entire area of Kahoolawe is absolutely destitute of all vegetation, the result of erosion by wind that since the cover of grass and other herbage was broken, has gone on with increasing destructiveness for many years. The process has now gone so far as to make efforts at reclamation extremely difficult. The problem presented, if it is possible to do anything at all, is to put back a cover of some sort of vegetation. Then to improve its condition. And so, eventually, to restore the island to a condition of productivity. The question is much more one of establishing soil binding plants than of tree planting, though of course windbreaks will have their place.

For some time now there have been no cattle on Kahoolawe. A few sheep yet remain and there is also a band of wild goats. The first move is, of course, to get rid of these animals. In terminating the old lease an arrangement was made to drive and kill a part of the goats.

Over perhaps a third of Kahoolawe is good pili grass and a scattering growth of Algaroba trees. This forest is spreading slowly but the process ought to be helped along.

Owing to the fact that no funds were provided by the Legislature for such work, no further attempt than the above mentioned action has as yet been made to undertake active work in the reclamation of Kahoolawe. Conditions have for a long time now been so bad over a large part of the island that it makes the outlay of any considerable amount of money on the barren portion partake of the character of a somewhat doubtful speculation. But it can be said that on the section of the lower lands where Algaroba is already growing, the stand should be extended. The trees are spreading naturally but if the process could be hastened it would be that much better. Were it found possible to devise some practicable but very inexpensive way in which assistance of this kind could be given, the matter would at least be worth considering.

FOREST PLANTING.

During the past two years especial efforts have been made by the Division of Forestry to push work in forest planting, both on Government land and by corporations on their own, fee simple property. The reasons for this are plain. In Hawaii the native trees do not yield wood suitable for structural purposes. Furthermore, in many of the districts where wood is most needed, the native forest has already been pushed back as far as or farther than is safe from a water protection standpoint. Consequently there, even the cutting of fire wood is, or should be, tabu.

On the other hand the demand for wood for all sorts of uses is constantly on the increase. Large quantities of lumber are annually imported from the American mainland and in the nature of things this must continue for many years. But there seems no good reason why wood and timber for minor uses, such as posts, ties, rough bridge and flume sticks and the like, should not be supplied from local grown trees. Then, too, fuel wood is an item of very considerable importance on plantations on the windward side of the islands, in localities where the Algaroba will not grow. Windbreak, roadside and ornamental planting also require annually a goodly number of trees of various species.

To provide a local source of wood supply is so evidently a good business proposition that it does not need any argument at all to prove it so. The main drawbacks to forest planting in Hawaii are the initial cost and the length of time that must necessarily elapse before returns can be got. But on both counts Hawaii is more fortunate than many places, for even if only fuel is cut, the yields from planted groves are sufficient to make the rate of interest on the investment a satisfactory one. With a longer term investment, yielding a higher grade of wood product, returns in Hawaii can, because of the fact that quick growing trees like the Eucalyptus are for the most part the ones used, be got very much sooner than in most places elsewhere in the United States.

The function of the Division of Forestry in this matter is, first, to make available information as to what, where and how to plant to get the results desired, and second, further to assist the planter of trees by supplying at cost price seed and seedlings of the species of trees locally most in demand.

A considerable part of the time of the Forest Nurseryman is devoted to the former work. Information is given out verbally, by correspondence, and through publications. In June, 1912, a new and revised edition was issued of the circular entitled "Instructions for Propagating Forest, Shade and Ornamental Trees." For a detailed account of this phase of the Division's work, the report of the Forest Nurseryman should be consulted.

EUCALYPTUS BULLETIN.

Perhaps it is not out of place here to make mention of a bulletin entitled "Eucalyptus Culture in Hawaii" that was issued in July, 1911, as Bulletin No. 1 of the Division of Forestry. This report, written by Mr. Louis Margolin of the U. S. Forest Service, gives the results of the investigation carried on in 1910 with the co-operation of the Forest Service, when all the planted groves of Eucalypts in Hawaii were visited and all the information locally available in regard to this genus got together. An edition of 3,000 copies was printed, so that the bulletin could be given wide distribution. For those who are minded to establish Eucalyptus plantations this bulletin contains much material that is of interest and value. Copies may be had upon application, without charge. A further account of the investigation itself may be found in the biennial report of the Division of Forestry for 1909-1910, page 41.

PLANT DISTRIBUTION.

The distribution of plant material during the past biennium has exceeded in number of plants given out any previous record. For the most part the tree seedlings are sold at cost, but also many plants are given away, free. Especially is this true of Arbor Day, when an effort is made to get trees into the hands of as many individuals as possible, each person who applies being given not to exceed 24 seedling trees, chosen by him out of one or more of about a dozen species. In 1911 the total number of trees given away at the Government Nursery on Arbor Day was 11,508. In 1912 it was 13,645. A phase of considerable importance in the plant distribution work is the supplying material for planting the grounds of schools and other public institutions, for street planting by local improvement associations and other similar clubs, and for use at the Army and Navy posts and stations. Up to the present practically all material of this class has been furnished free, save that the Department of Public Instruction has paid the freight on shipments made to schools.

Regularly the Government Nursery does not deal in ornamental vines and shrubs, but in the case of certain schools and of the Army an exception has been made and more or less plant material of this sort has been got ready for planting out. The justification of such co-operation rests on the desire of the Territory to assist the Federal Government in every way possible.

In addition to its plant distribution to individuals, the Division of Forestry has in the past two years furnished large numbers of small seedlings to sugar plantation companies throughout the islands at cost. Many of the plantation managers are willing to set out a few thousand trees every year, but do not care to be bothered with the trouble of raising them. Under a plan that has been carefully worked out by the Division of Forestry, seedlings for this use can be got cheaply from the Government Nursery in seed boxes. The seedlings are not sent out until they have passed the "damping off" stage and are ready for the first transplanting. This any laborer can do, and then after a time set out the little trees in their permanent place without more than ordinary supervision.

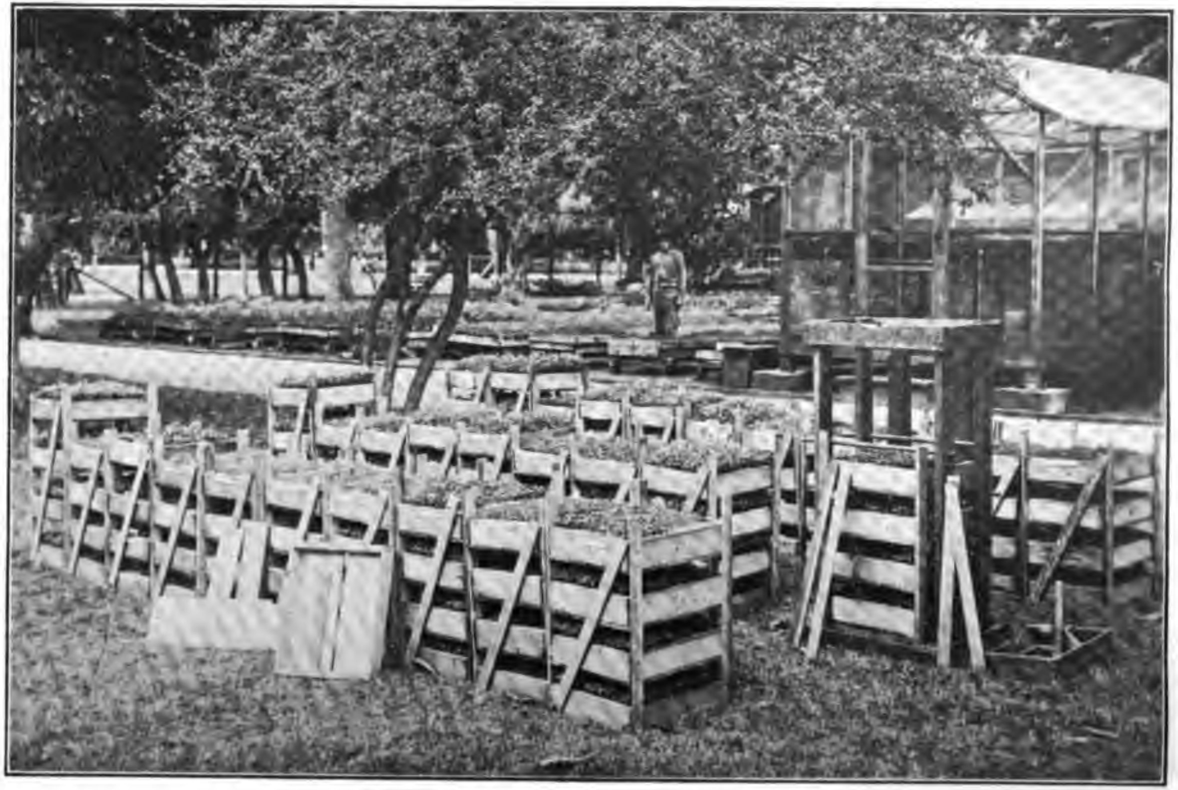


Plate 11. A Shipment of Seedlings for a Sugar Plantation Company. Packing frame at the right. Plant boxes and box shooks at left.

In 1911, 349,000 seedling trees were grown and sent out for this class of planting. In 1912 the orders (to be filled during the winter of 1912-13) amounted to 666,730 trees. One plantation company alone wanted 500,000. Considering that a few years ago the total number of trees planted in the Territory was officially estimated at 498,677 (1908), this is certainly a gain worthy to be noted, for of course only a part of the trees now annually planted throughout the Territory come from the Government Nursery.

Seed as well as seedlings of the trees most in demand for local planting is kept on hand at the Government Nursery at Honolulu, for sale at cost price. As far as possible the tree seed is collected locally so as to secure the advantage of acclimatization. With species that do not seed readily here, seed is purchased from commercial seedsmen elsewhere and imported. Upon request the Division of Forestry will endeavor to procure seed of any kind of tree desired by any citizen of the Territory, the only charge being the actual cost of the seed itself.

SUB-NURSERIES.

Besides the Government Nursery at Honolulu, as a part of and in connection with which is maintained the substation and experimental garden in Makiki Valley, there are at present two subnurseries of the Division of Forestry on the other islands. These are respectively at Hilo, Hawaii, under the charge of Brother Matthias Newell, and at Homestead, Kauai, under the direction of Mr. Walter D. McBryde. To both these gentlemen it is appropriate that a renewed expression of thanks should here be made, for without their generous contribution of much time and thought it would be impracticable under present conditions for the Division of Forestry to maintain these stations.

Following is a table which shows the totals of seedling trees distributed from Division of Forestry nurseries in 1911 and 1912:

TOTALS OF DISTRIBUTION OF SEEDLING TREES.

Sold and Given Gratis from Division of Forestry.

Nursery	1911	1912
Government Nursery, including Makiki Station, Honolulu	597,396	787,704
Hilo Nursery, Hawaii	12,104	12,490
Homestead Nursery, Kauai	11,239	6,343
Total	620,739	806.537

A detailed tabulation of these figures, showing the numbers of trees supplied for various classes of planting is given in the report of the Forest Nurseryman.

The need for other sub-nurseries in various districts on the several islands, pointed out in previous reports, continues to increase. In a few places on Maui and on Hawaii, temporary arrangements have been made with plantation companies and others to supply trees to individuals for local planting, especially at Arbor Day time. But there ought to be better provision made for this phase of the work. People on Maui, for instance, have just as good a right to a local Nursery as persons in Hilo. Provision should be made for the establishment of more sub-stations.

As it is now, apart from the seedlings distributed from depots established by temporary arrangement, a good many plants are of course shipped from Honolulu, so that those who really want them have no need to go without. But, obviously, a local nursery has its advantages, to say nothing of the saving of time, cost and liability of damage over inter-island shipments.

TREE PLANTING BY CORPORATIONS.

Without reference to where the plant material came from, it can truly be said that interest in tree planting by corporations has increased markedly during the period of this report. Most of those sugar plantations which were before doing a good deal have increased their activities. Others that had not before engaged in tree planting have taken up the work. And best of all, almost all the planting by corporations is being done in a careful and systematic manner, which should insure the ultimate success of the trees set out.

Tree planting by sugar plantation companies can naturally be divided into three classes: wind breaks, roadside planting and camp adornment, and planting for direct economic return through wood production. Within the past two years noticeable additions have been made to the shelter belt of Ironwoods (*Casuarina*) along the windward shore of Hawaii in the Hamakua and Kohala Districts. Similar planting is also in progress on Maui, Oahu and Kauai. On good authority it is stated that in the lower fields on windward plantations which are protected by an Ironwood windbreak, the yield of sugar has been increased very appreciably, as much in some cases as one half ton or more per acre. Also it has been possible in some cases to bring some new fields under cane since windbreaks were established.

Of the planting of roadside trees and ornamentals near the camps no special mention is necessary except that it might well be noted that practically all the leading sugar companies are paying much more attention to the appearance of their mill grounds and camps than was the case even a few years ago—a movement that certainly is to be encouraged.

Tree planting for commercial return by sugar plantation companies is usually confined to areas unavailable for agricultural crops, such as gulch sides, rocky corners and the like, that would otherwise be classed as waste land. Almost every plantation has such land. Much of it is in close proximity to camps where live the people who would be the chief users of fuel wood. But whether trees are planted with the object of producing fuel or some other form of wood, it is good business so to utilize areas that would otherwise lie unproductive. The plantation companies that are vigorously carrying on such work now will benefit from it largely in the future.

The accompanying table, compiled from answers to a general request for tree planting data sent to sugar plantations, stock ranches and other large tree planters, shows approximately the total number of trees set out throughout the Territory during the past two years. The figures in each case are those given by the companies themselves. While of course the grand total cannot be claimed to include all trees planted, it is thought to be a pretty close approximation to the true figure. Naturally this table includes all classes of tree planting, as have similar estimates in former years. For comparison the totals for the last five years may be given, as follows:

Total Number of Trees Reported Planted, 1908-1912.

1908	1909	1910	1911	1912
498,677	597,381	725,022	1,134,940	1,303,698

As in past years the Division of Forestry stands ready, upon request, to draw up planting plans for any locality in the islands, having in mind the desire of the owner for one or another type of forest, and based on a study of the local conditions. The cost of this service consists merely in the traveling expenses of the agent sent. As has already been said, plant material can be obtained from the Division of Forestry at cost price.

Table Showing Number Of Trees Planted In The Territory Of Hawaii, Mainly By Corporations, In 1911 and 1912.

Name of Corporation.	Number of Trees Planted.* 1911.	1912.
Kauai.		
Princeville Plantation Co.	....	10,000
Kilauea Sugar Plantation Co.	2,000	2,000
Makee Sugar Co.	14,908	17,195
Lihue Plantation Co.	20,000	20,000
Grove Farm	25,000	45,000
Koloa Sugar Co.	....	17,770
Hawaiian Sugar Co.	10,000	40,000
W. D. McBryde (Kukuiolono Park)	42,000	3,000
Papapaholahola Reserve	4,000	9,538
McBryde Sugar Co.	....	17,300
Waiawa Ranch	....	1,000
Lihue Ranch	72,000	161,000
A. S. Wilcox (Kilohana)	2,500	20,000
Rev. Hans Isenberg (Kukaua)	1,100	1,600
Homesteaders on Kauai	15,000	10,000
Totals for Kauai	208,508	375,403
Oahu.		
Kahuku Plantation Co.	5,000	8,000
Waialua Agricultural Co.	50,000	10,000
Waianae Co.	5,177	3,336
Honolulu Plantation Co.	100,000	125,000
Ii Estate (Waipio)	19,042	20,000
Kunia Development Co.	21,058	59,797
O. R. & L. Co. Ranch Department	5,000	....
C. G. Owen (Pupukea)	1,000	2,000
Pupukea Forest Reserve	....	1,000
Waimanalo Sugar Co.	12,000	16,000
Francis Gay (Kalihi)	....	5,000
Totals for Oahu	218,277	250,133

---

*A number of sugar plantation companies and others report that owing to the prolonged drought of 1912 seedling trees that would otherwise have been planted out during the year are still held in the nursery.

Maui, Lanai and Molokai.

Maui Agricultural Co.		
Kailiili and Opana	300,000	417,000
Paia Nursery	50,000	29,511
Hawaiian Commercial & Sugar Co.	6,594	7,780
Wailuku Sugar Co.	11,405	17,009
Haleakala Ranch	1,450	8,250
Honolua Ranch	....	500
Polipoli Forest Reserve (Wailuku)	....	2,686
Koolau District (H. C. & S. Co.)	18,015	66,812
Homesteaders on Maui	5,000	5,000

Molokai and Lanai.

Molokai Ranch	15,000	18,000
Kalawao (Bro. Joseph Dutton)	3,760	500
Lanai Ranch (Koele)	500	8,000
Totals for County of Maui	411,724	581,048

Hawaii.

Niulii Mill & Plantation	1,730	6,020
Kohala Sugar Co.	20,000	12,000
Puakea Co.	710	575
Pacific Sugar Mill	5,000	10,000
Hamakua Mill Co.	25,000	....
Honokaa Sugar Co.	10,000	10,000
Kaiwiki Sugar Co.	400	500
Kukaiau Ranch	45,003	29,070
Hawaiian Agricultural Co.	9,000	....
Homesteaders in Kau	25,000	5,000
W. R. Castle (So. Kona)	....	2,000
Parker Ranch		
Kohala Mt.	128,437	5,888
Waiki & Makahalau	10,500	....
Paauhau	14,151	14,561
Other localities	1,500	1,500
Totals for Hawaii	296,431	97,114

Summary.

Kauai	208,508	375.403
Oahu	218,277	250,133
County of Maui	411,724	581,048
Hawaii	296,431	97,114
Grand Total	1,134,940	1,303,698

SPREADING THE ALGAROBA.

One other forest suggestion that is pertinent here is that more systematic effort should be made by those owning or controlling considerable areas of low lying land along the lee coasts of the several islands, to extend the Algaroba forest. Of course, through natural reproduction this tree is spreading now in almost every district, but there are many localities where the process should be assisted. When land of poor character, dry and rocky, can so easily be increased in value as by establishing on it an Algaroba forest it would seem to require little argument to induce land owners to take the simple steps necessary to bring such afforestation about. As a bee pasture, as a source of stock feed and as a producer of fuel-wood, Algaroba is of increasing value in Hawaii. Provision ought to be made by the Territory to increase the Algaroba forest on Government lands. Private owners should put into force a similar program on their holidngs.

TREE PLANTING ON GOVERNMENT LAND.

Within the past two years the Territorial Government has resumed forest planting on its own lands, both directly under contracts for planting given areas, and also through requirements in public land leases whereby the lessee is obligated to establish a given number of trees within a certain period on specified tracts.

Pupukea, Oahu.

Two areas have been planted directly by the Government under contract. One is a portion of the Pupukea Forest Reserve, Waialua District, Oahu. Here on what was formerly known as "Water Reserve C" are now between 30 and 35 acres of forest, mainly Swamp Mahogany (*Eucalyptus robusta*). This work was begun in 1910, as was noted in the report of this Division for that year, and completed in the early part of 1911. Final payment under the contract was made in October of that year. The result of this planting is a vigorous stand of thrifty, well developed trees.

In February, 1912, a special agreement was entered into with Mr. C. G. Owen, whereby in return for the privilege of growing two crops of pineapples on some remnants of open land on the bluff adjoining the Pupukea forest plantation, he is then to plant trees on the area so cultivated. The satisfactory performance of this tree planting is insured by a bond fully covering the cost of the work. This particular planting will join and extend the stand already established.

Waimea, Hawaii.

The other locality planted directly by the Government is on Kohala Mountain, above Waimea Village, Hawaii. In May, 1911, a contract was signed with Mr. A. W. Carter, Manager of the Parker Ranch, under which, in accordance with a planting plan drawn up by the Division of Forestry, 50 acres were planted during the winter of 1911-12. Here again Eucalyptus robusta was the principal tree used. The planting having been satisfactorily completed, payment of the contract was made in the summer of 1912 in two installments.

A continuation of this planting has been made by the Parker Ranch on adjoining fee simple lands, so that altogether a considerable block of forest will soon be in evidence. The areas planted were open slopes on the hills above Waimea, adjoining the native forest out of which come streams now tapped for use on the Waimea plains. The object of the planting is to utilize otherwise unproductive land and in part to form a buffer belt, or transition zone between the native forest and the open grazing land. Under the peculiar conditions that obtain in the Hawaiian islands the outer edge of the native forest is often in poor health and reduced vigor. Unavoidable encroachments from the outside where the forest touches agricultural land, the spread into the forest of rank growing grasses. incursions by men and animals, and in places the danger of damage by fire, all tend to work injury to the close cover that is the characteristic and valuable feature of the indigenous forest

By keeping the outer boundary of the forest somewhat farther out than in itself is actually required for watershed protection, the welfare of the forest as a whole is the better maintained.

In the "wet" or water-bearing forest on the catchment basins of streams especially needed for irrigation, the retention of this "buffer belt" is a matter of much importance. For the most part the buffer belt should consist of an extension of the native forest cover. Where the cover is broken it should ordinarily be renewed through encouraging a return of the native vegetation, but in some few places a planted stand of introduced trees can be used to advantage to bridge the outer zone. In such places the planted stand can serve also as a source of local wood supply. The planting above Waimea Village falls into this latter class. Both purposes will there be served by the stand planted.

Planting Under Government Lease Requirements.

Under the requirements of Government leases issued by the Territorial Land office, forest planting is in progress on several tracts on Hawaii now under the control of the Parker Ranch and of the Kukaiau Ranch. Visits of inspection were made to these localities in the summer and autumn of 1911, when the tree planting work was found to be going on satisfactorily in accordance with the requirements of the leases.

In December, 1911, a planting plan was drawn up for certain Government lands in the Kula District, Maui, now under a lease to the Cornwell Ranch, carrying similar requirements. Planting on these lands, delayed during the past summer by unfavorable weather conditions, is now in progress.

Through the voluntary co-operation of two sugar plantation companies—the Waianae Company on Oahu, and the Wailuku Sugar Company on Maui—forest planting is now going on on Government land in forest reserves above those plantations. In both cases grass-covered slopes on the foot hills are being reforested, mainly with Eucalypts. At Waianae 5177 trees were planted in 1911; 3336 in 1912. Above Wailuku, the planting of the land of Polipoli did not begin till 1912, when 2686 trees were set out.

FUNGUS DISEASE ON EUCALYPTUS.

During the autumn of 1912 the plant pathologists of the Hawaiian Sugar Planters' Experiment Station called attention to a fungus which is killing Eucalyptus trees in various parts of the Territory. Perhaps the place where the trouble has been most noticeable is the Tantalus Forest, back of Honolulu, where many large trees have been killed. Up to now the Eucalypts in Hawaii, except for injury from a leaf-eating beetle on one or two species, have been remarkably free from insect pests, blights and similar troubles so that the appearance of this fungus is an unpleasant surprise.

As yet not as much has been found out about the fungus as will be known when investigations now in progress are completed, but the indications seem strongly to be that it is most likely to attack individual trees rather than groves as a whole, so that if somewhat greater care is given the stand than has been thought necessary in the past, there need be no great cause for worry over a diminution of returns. Instead of periodical thinnings it may become necessary to remove individual trees should they die, whereby the spread of the fungus may be that much checked. This has been done on Tantalus the past autumn, the wood being sold for fuel, as it might be from any other stand.

Basing the statement on information now in hand, it may be said that the danger of the disease becoming epidemic and attacking all the trees of a given grove at once seems remote. Exceptional climatic conditions favorable to its spread might of

Plate 12. Papapaholahola Sub-Nursery and Experimental Planting Ground, Homestead, Kauai.

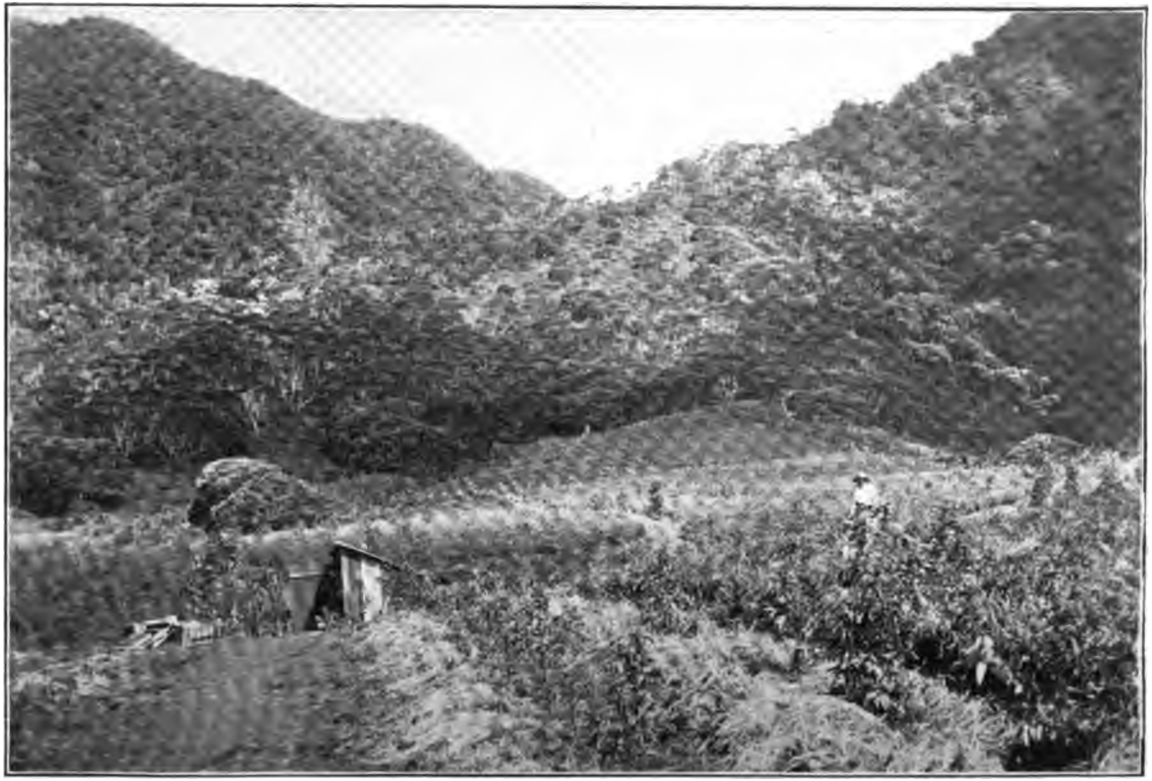


Plate 13. **Experimental Eucalyptus Plantation, Nuuanu Valley near Honolulu.**

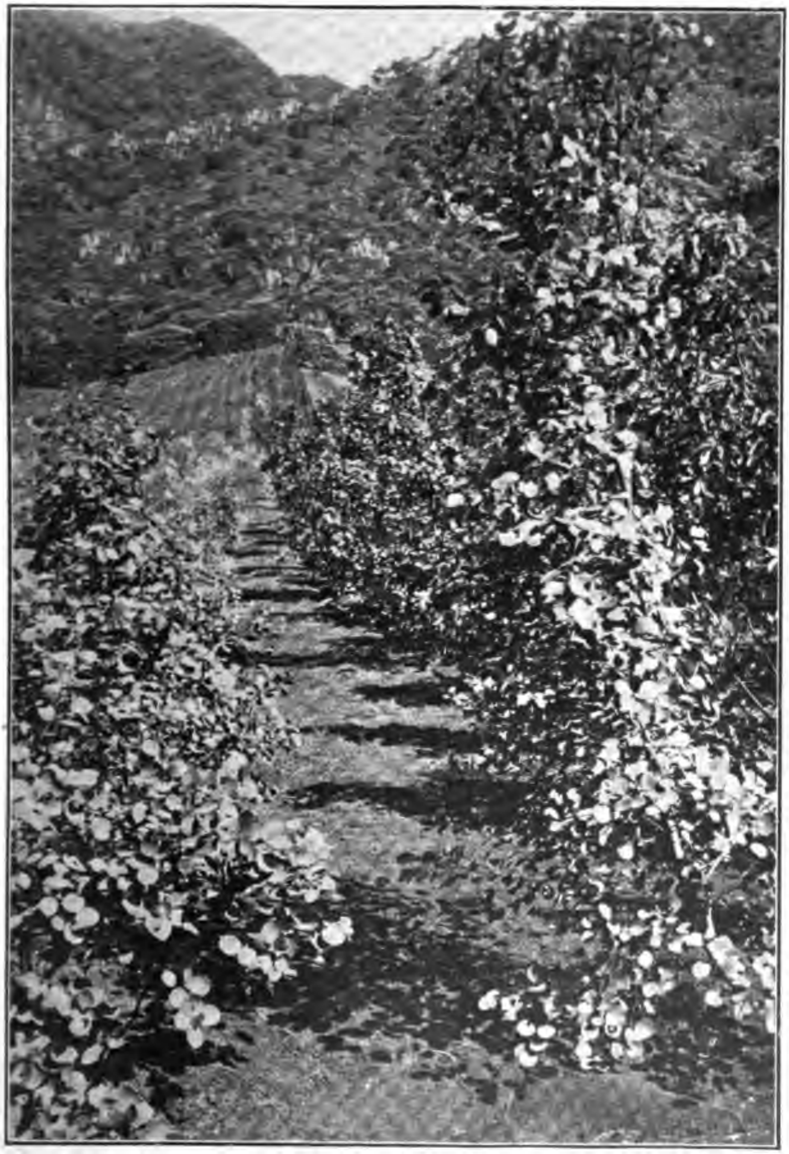


Plate 14. Eucalyptus Robusta Windbreak, Nuuanu Valley Plantation.
Two years and ten months from seed. Rows of Eucalyptus corynocalyx at left.

course occur but taken by and large it seems probable that only a small percentage of the trees in any one stand would be attacked. As Eucalyptus plantations need to be thinned vigorously anyway and as the margin of profit in this form of investment in Hawaii is considerable, there seems no good reason for discontinuing the planting of Eucalypts for commercial returns, especially on waste lands adjoining sugar plantations, provided the work is gone about in the right way to start with, and a reasonable amount of subsequent care can be assured.

PLANT INTRODUCTION WORK

EXPERIMENTAL PLANTING.

An important phase of forest work in Hawaii is the introduction into the Territory of exotic trees of economic importance. This is a line of investigation that should receive much greater attention than has been given it in recent years. Much of the attractiveness of Honolulu and of our other towns today is due to the introductions made years ago by Dr. Hillebrand and the men in charge of the Government Nursery in its early days. Many of the trees brought in by them were ornamentals. What is needed now is to try out species primarily of economic and commercial value. There is also a real need for supplementing our native flora by the introduction of trees and shrubs of generally similar botanic character that could be used for replanting areas in the water-bearing, protection forests, where for one or another reason, native Hawaiian plants cannot well be used.

Such experimental work is necessarily slow, and to be effective requires careful and painstaking devotion to details by well trained men. It is slow also because many of the plants tried will unavoidably be found to be unsuited to local conditions. But those that do succeed more than offset the failures.

With the machinery now at hand at the Makiki Experimental Garden, a slight additional outlay would enable many new trees to be started there for use at the lower levels. If then, provision could be made for planting out and caring for these new species from Makiki, and as well from other experimental nurseries located at suitable places throughout the Territory, at various elevations and under varying climatic conditions, a work of great value to the people of the islands would be accomplished. Especially should propagating stations be established at the higher elevations on the larger islands adjacent both to the native wet forest on the one hand and the high slopes of the great mountains on the other. It is urgently recommended that provision be made for such investigations.

A NEW INTRODUCTION.

Through the courtesy of Hon. A. de Souza Canavarro, Consul for Portugal at Honolulu, this office received, early in 1911, a consignment of basket willow cuttings, brought direct from the Azores by Dr. L. R. Gaspar. These were planted in the Makiki Station grounds, where they did remarkably well. In January, 1912, when the holts were first cut, a number of baskets were made up, as is shown in the accompanying illustration. In the Azores furniture and a variety of articles in addition to baskets, are made from willow. There seems no reason why the same should not in time be the case here.

During the present winter cuttings will be distributed to persons desiring to establish stands of basket willow. In this way the initial steps are being taken to create a new industry in Hawaii, one that in time may give employment to many persons.

PAPAPAHOLAHOLA STATION, KAUAI.

In connection with the sub-nursery maintained by the Division of Forestry at Homestead, Kauai for the distribution of seedling trees to persons in that vicinity, a forest trial ground has also been started, where will be planted out many trees new to Hawaii. Of this experimental plantation, known locally as the "Papapaholahola Reserve," the agent in charge, Mr. Walter D. McBryde, has the following to say:

"The Reserve covers 39½ acres, the whole of it being fenced in. I have had some ten acres of this plowed, a part of which has been well harrowed preparatory to its being planted to trees. I have found that this initial expense is well repaid in the quick growth of the trees, thus also making a great saving in the care and cultivation of the trees owing to their shading the ground and thus keeping down the grass and weeds.

"According to figures kept by the head worker at the Reserve, we have planted out during the year 1912 a total of 9,538 trees of the following varieties: Eucalyptus robusta, Blue Gum, E. diversicolor, Sugi or Japanese Cedar, Ironwood and Mexican Algaroba. In 1911 there were planted something over 4000 trees.

"The Papapaholahola Spring Reserve is becoming quite a show place, owing to the good work being done by the two men allowed by your Department and if the work is continued along the same lines as at present undertaken, the Government will have a Forest Reserve of which they can well feel proud."

From a personal inspection of this tract made in the summer of 1912, I am inclined to speak with enthusiasm of the good progress made. Were there other experimental tracts like this one, distributed throughout the Territory, much more rapid advance than at present would result in securing definite, practical data as to the value for one and another purpose of newly introduced trees.

FOREST PLANTING IN KOOLAU, MAUI.

In co-operation with and at the expense of the Alexander & Baldwin Interests, experimental planting of certain introduced trees was undertaken in the summer of 1911 in a section of the forest bordering the irrigation ditches in the Koolau District on the Island of Maui. This work is being done in the locality where portions of the native forest died out a few years since from a cause that has never been satisfactorily explained. Shelter belts have been started in several places to provide protection from the wind to limited areas where it is proposed to try out special things. Experimental lots of a number of species of trees new to Hawaii are being planted to ascertain if among them are not kinds adapted for use under the conditions obtaining in this particular section, while other experiments are in progress to determine the best methods of propagating on an extensive scale, certain of the native Hawaiian forest plants that are valuable as members of the plant community that makes up the water-bearing forest.

In April and May, 1911, an arrangement was made whereby Mr. H. M. Curran of the Philippine Bureau of Forestry visited Maui to confer with those locally interested, in their efforts to devise ways and means of handling this forest to the best advantage. A brief report containing Mr. Curran's recommendations was published in the Hawaiian Forester and Agriculturist, June, 1911; Vol. VIII, No. 6.

FEDERAL EXPERIMENTAL TREE PLANTING.

Nuuanu Valley.

In the interest of forest extension, the Forest Service of the United States Department of Agriculture has for several years now made an allotment for experimental forest planting in Hawaii. In the beginning all the money was used for the trial of temperate zone trees in fenced enclosures on the upper slopes of Mauna Kea and Mt. Haleakala. In 1911 an experimental plantation of Eucalypts was established on land controlled by the Honolulu Water Works above Luakaha, in Nuuanu Valley. Sample plots of eighteen different species of Eucalyptus were planted, kinds as yet little known in Hawaii but reputed to be of economic importance. Some additional planting and filling up of the blocks to their full quota of trees was done in 1912. On the windward side of the plants a double line of Swamp Mahogany (*Eucalyptus robusta*) was set out, as a windbreak. This experimental plantation should yield valuable data in years to come. The species so far planted are as follows:

E. corynocalyx
E. crebra
E. gomphocephala
E. goniocalyx
E. leucoxylon
E. loxophleba
E. melanophloia
E. microcorys
E. microtheca
E. muelleriana
E. obliqua
E. pilularis
E. redunca
E. rostrata
E. rubida
E. siberiana
E. smithii
E. tereticornis

Experimental Plots on the High Mountains.

Results from the sowing of tree seed in fenced enclosures on Mt. Haleakala and Mauna Kea have as yet been but meager, but enough has been accomplished to indicate pretty clearly that were it possible to give more care and attention to this line of investigation much better returns could be looked for. Counts of seedlings in the seed spot beds in the several plots on both mountains made in the summer and autumn of 1911 showed that with a number of species of conifers the percentage of seedlings that had germinated and lived through the first season was sufficiently large to be really encouraging.

The purpose of sowing tree seed direct was to find out if the seed spot method was at all practicable under the conditions obtaining in Hawaii and to get an additional line on the behavior of the species tried. No very large returns were expected but as the cost of sowing the seed was very little, it was felt that the effort was justifiable. Experiments of this sort should be continued, for if one or two species of conifers can be found that will grow on the upper slopes of these mountains it will mean much to the Territory.

Seedlings of the following species were found, among others, to have germinated and apparently to have started to grow in a number of the plots, both on Maui and on Hawaii; *Pinus coulteri*. *P. contorta*, *P. ponderosa*, *P. murrayana*, *P. insularis*, *P. sylvestris*, *P. radiata*, *Cupressus arizonica*, *Libocedrus decurrens*, *Picea engelmanni*, *P. parryana*, and *Pseudotsuga taxifolia*.

The amount alloted by the U. S. Forest Service for experimental planting in Hawaii was $750 for the fiscal period ending June 30, 1912. For the present year it is $500. The greater part of the money for this year and last has been expended for the wages of laborers used in planting out and caring for the Eucalyptus in the Nuuanu Valley Plantation.

MISCELLANEOUS FOREST WORK.

In addition to the lines of work which comprise the main activities of the Division of Forestry, no inconsiderable amount of energy is expended in efforts, not always easy to classify, which are designed in one way or another to benefit the people of the Territory.

REPORTS AND PUBLICATIONS.

Under the heading publicity might be mentioned the written reports which are made to the Commissioners on all important matters.

Whenever a forest reserve is to be set apart a report is made summing up the reasons that underlie the action recommended. It is on the basis of this report that the Board requests the Governor to take the action required by law. From time to time, too, special reports are prepared on the condition of given forests or on particular problems that arise in connection with their administration. These reports are, of course, all based on field work, usually done by the Superintendent of Forestry. Monthly routine reports are also prepared to keep the Commissioners informed of the current work of the Division.

All of these reports are made public through the pages of the Hawaiian Forester and Agriculturist, the monthly journal issued under the auspices of the Board of Agriculture and Forestry. It It is a part of the policy of the Board so to issue them, for the desire with forest work, as with all other activities of the Board, is to give the work being carried on such publicity that everyone who is interested in, or concerned by it can be fully informed as to what is going on. While necessarily some of these reports are technical in character the effort is always made to couch them in terms that anyone can understand.

Mention has already been made of Bulletin No. 1, "Eucalyptus Culture in Hawaii," by Mr. Louis Margolin of the U. S. Forest Service, and of Circular No. 2, "Instructions for Propagating Forest, Shade and Ornamental Trees," by David Haughs, Forest Nurseryman, issued respectively in 1911 and 1912. The only other publication of the Division of Forestry, issued during the past two years, outside of contributions to the Forester and Agriculturist, was the Biennial report for 1909-1910, which appeared on March 11, 1911.

In further effort to bring a knowledge of the reasons for forest work home to the people of the islands, public addresses are made occasionally by the Superintendent of Forestry before various organizations. In December 1911 a paper of this sort was read at the annual meeting of the Hawaiian Sugar Planters' Association and a talk was given to the pupils of the Normal School on Arbor Day of that year. A paper on Street Tree Planting read before the Kilohana Art League was later published in more extended form in Thrum's Annual for 1913. This paper contains a list of trees suitable for use locally for this purpose, with brief notes in regard to each species.

There are increasing calls for a popular bulletin descriptive of the common introduced trees planted in Honolulu. It is hoped that such a publication can be prepared and issued by the Division of Forestry. It would meet a real demand.

BOTANICAL SURVEY.

Until September, 1911, Mr. Joseph F. Rock was a regular member of the staff of the Division of Forestry. He was then transferred to the faculty of the College of Hawaii. Mr. Rock continues, however, as an honorary officer of the Board with the title "Consulting Botanist."

Under a carefully worded agreement, the herbarium of the Board of Agriculture and Forestry, with the cases in which it is housed, has been loaned to the College of Hawaii. The collection was transferred to the College building in Manoa Valley in the summer of 1912. It may there be consulted by those interested.

In the spring, of 1911, Mr. Rock made collecting trips to Hawaii and Maui and that summer again visited the Kau District on Hawaii. On each of these expeditions he collected much new herbarium material which was added to the collection. Pending the completion of the new building of the College of Hawaii, Mr. Rock continued to occupy quarters at the Board's office on King street, until July, 1912.

In September 1911 there was issued as Botanical Bulletin No. 1 of the Division of Forestry, an illustrated 15 page pamphlet entitled "New and Noteworthy Hawaiian Plants." In December 1911 another similar bulletin was issued by the College of Hawaii describing some additional new species, under the title "Notes upon Hawaiian Plants with Descriptions of New Species and Varieties." By means of a fund raised through private subscription, Mr. Rock expects in the near future to publish an illustrated book on the native trees of Hawaii, based upon data collected by him during his active connection with the Board. A brief report by Mr. Rock outlining certain interesting finds made by him on the Island of Hawaii, including one rubber producing tree, a Euphorbia, appears elsewhere in this volume as a special contribution.

FOREST FIRES.

With the exception of a few small brush and grass fires on Oahu and Kauai, all of which were extinguished before serious damage had resulted, the forest fire record for the years 1911-1912 is fortunately small. One of the fires on Oahu occurred in Manoa Valley in April 1911. The others, and there have been a number of them, were in the Ewa District in the vicinity of Leilehua and Wahiawa. The fires on Kauai were in the woods back of Kilauea. Both occurred in June, 1911.

But while fortunate in escaping much damage from forest fire during this period, the Territory is by no means immune from forest fire danger. The liability of fire is always present unless there is a watchful and efficient forest fire service ready and able to take prompt action when ever necessary. And further, back of any system of fire fighting there must be public sentiment.

Thanks to the efforts of the local district fire wardens a much better appreciation of the dangers of forest fires prevails now than formerly but there is still room for improvement. Particularly is it true that new comers to Hawaii should take more than ordinary precautions in the use of fire in or near the forest. Much of the native vegetation, even that growing in the truly wet forests, is extraordinarily inflammable. The common Staghorn fern and the Ie-ie vine are both examples. Both will burn readily even when in full leaf. Then, too, the Staghorn always has a lot of dry leaves and twigs underneath, that add to the flames.

The number of grass and brush fires, especially on Oahu in 1911 and 1912, indicate clearly enough a lack of care in throwing down burning matches and cigarettes. So far, thanks to prompt attention, serious damage has been averted, but one can never tell when the time will come when a fire may get beyond control and spread over half the Koolau range. Besides, each time a grass or brush fire has to be fought, it means just so much expense and loss of time for those who turn out.

Everyone who has to do with the forests of Hawaii in any way should have it on his mind to be careful about fire. All those in charge of others would do well to issue strict instructions in regard thereto. Only through the cooperation of all concerned can we expect to be wholly free from this danger.

In this connection the recommendation is again made, and that most urgently, that a special fund be provided from some source for fighting forest fires on Government land. At present this Department is powerless to take effective steps, except through the voluntary cooperation of corporations or individuals, in combatting fires in the forest reserves that consist of unleased government land. There should be an emergency fund of at least $5,000 per annuam maintained for this purpose. This is one of the forest matters that decidedly demands attention.

As in earlier years one ranger was employed throughout the period to patrol the Tantalus forest and to oversee the burning of brush, under permit, on Tantalus Heights.

Several changes in the staff of volunteer fire wardens have lately been made by which the efficiency of the service as a skeleton organization is maintained. A revised list of the District Fire Wardens appears elsewhere in this volume.

SUMMARY OF RECOMMENDATIONS,

From the statements in the foregoing pages it should be evident that at the present stage of the game in Hawaii the essential need in forestry is for the better protection of the native forests. And this is required not because of the worthiness of the forest in itself to be cared for, but because on the forest depends the continuance of an assured water supply. There are other needs, too, for there is much forest work in Hawaii that requires urgently to be done, to say nothing of tree planting on waste lands that will unquestionably be of profit to those who undertake it. But first and foremost at this time comes the call for better care of the existing forests on the watersheds. The necessary steps to be taken are fencing and the eradication of wild stock in the forest reserves—cattle, goats and pigs—which should be followed by the extension of the forest, through planting, where the cover has been broken from any cause.

To carry out as it should be done, these extensions of forest work will necessarily require larger expenditures than have been made in the past. To meet this demand a portion of the revenues now derived by the Territorial Government from water licenses on streams in the forests should be devoted to forest work. In a word, some of the money derived in these islands from water, a product of the forest, should be reinvested in the forest, to the end that for the future the supply of water may be assured, if indeed it cannot be increased. A revolving fund so established will in the end pay itself back many fold. It is the experience of all countries where forestry is practiced that the reinvestment, up to a certain point, in forest administration of the revenue derived from the forest, leads to an increase in subsequent returns. Hawaii would be no exception to this general law. Provision should be made for getting the adequate protection of the forest started without more delay. This is a matter that should be brought in the most forcibly way possible to the attention of the Legislature.

Along with the adequate protection of the native forest, the activities of the Division of Forestry should be carried on in accordance with the general program that has been in force for the past several years. The growing and distributing of seedling trees, free or at cost price, from the Government Nursery at Honolulu and from sub-stations on the other islands; the extension of this work through the establishment of additional sub-nurseries in other districts; the continuation of the policy of furnishing advice and suggestions as to tree planting and other forest work; and the prosecution, for a while longer, of the campaign of education as to the necessity and desirability of forest work, until a larger proportion of the owners of fee simple land that should be under forest cover take effective steps to make it so; these are all lines of activity that should be continued; that could to the advantage of the people of the Territory, very well be expanded.

In addition tree planting by private corporations should be further encouraged, both as to the planting of stands of commercially valuable trees for fuel, posts, etc., on waste areas near plantation camps, and also as to spreading the Algaroba forests along the sea coasts of the several islands.

The forest fire danger in Hawaii is fortunately not great in most districts, but for this very reason all the more care should be taken to keep fire out of the forest altogether. New comers to Hawaii have difficulty in appreciating how inflammable much of the native vegetation is, even in the true wet forests. With the increasing necessity for keeping our water sheds in the best possible condition it is essential that no chances be taken with fire. The recommendations made in earlier reports that an emergency fund be provided for fighting forest fires on government forest land is here repeated with added emphasis. The need is more urgent now than ever before. From some source money must be provided for this purpose.

The practice of forestry in Hawaii is not a panacea for all the difficulties that beset the Territory, but it is one of the essential factors in the maintenance of our present economic prosperity. If the people of Hawaii will but stop to think, the connection between forest protection and assured stream flow is so obvious that it cannot escape even casual attention. Water is something that everyone must have. The only way in Hawaii of being sure of getting it in abundance is to keep the water sheds covered with dense vegetation. While there is yet time, let us then Save the Forests.

Very respectfully,

RALPH S. HOSMER,

Superintendent of Forestry
and Chief Fire Warden.

Report of the Forest Nurseryman.

Honolulu, Hawaii, December 31, 1912.

R. S. Hosmer, Esq.,
Superintendent of Forestry,
Honolulu, Hawaii.

Dear Sir:—I herewith submit a report of the work done at the Government Nursery and Makiki Station, etc., for the years 1911 and 1912.

NURSERY.

Collection and Exchange of Seeds.

The collection is done principally by two boys who have to be proficient in the climbing of trees. This work can be done more economically and safer with two working together than one. One boy climbs the tree and the other directs where the best seeds are. He also gathers up the seed that is thrown down. We have found that it is necessary to have two together when climbing in case of accidents. We are glad to say that so far we have not had any serious accidents although the boys have had several bad falls.

The most of the seed is collected in and around Honolulu. A great deal of our Eucalyptus, also Koa, is collected on Tantalus. Mr. J. F. Rock, Botanist, collected and handed to us large quantities of indigenous seed of rare plants. This has been distributed to people who were particularly anxious to get seed of the native plants of the Islands. The cleaning and drying of the seed is done at the nursery and this work takes a great deal of time, some of the seed being quite difficult to separate from the pods or seed vessels. Some varieties, however, are easily handled. The seed boys also prepare packages for mailing and for distributing to people who may call at the Nursery.

Exchange of Seed.

During the period covered by this report we have had letters from a number of Botanic Gardens and Experiment Stations in addition to our regular list asking that they be put upon our seed exchange list. We have also received numerous printed lists giving the names of hundreds of species which would be mailed to us free upon application. We have not taken advantage of these offers of seed for the reason that we are not equipped sufficiently at present to give them a fair trial. We have supplied seed free to those who have made application for the same, including homesteaders and others all over the islands. Many of the tourists visiting the islands and those passing on steamers from and to the Orient and to the Australian Colonies call at the Nursery and ask for seed. Hardly a day passes without some callers of this sort. Not a little seed is given out in this way, a considerable part of it gratis.

Seed Received Through Exchange.

1911.	No. Pkgs.	
Feb. 28	9	Government Gardens, Koshun, Formosa.
Mar. 24	57	Jewish Agricultural Experiment Station, Haifa, Palestine.
Mar. 27	61	Gerrit P. Wilder, Honolulu.
April 4	4	Arnold Arboretum, Jamaica Plain, Massachusetts.
April 15	1	Marsden Manson, City Engineer, San Francisco.
April 25	2	Gerrit P. Wilder, Honolulu.
April 26	1	Botanical Gardens, Buitenzorg, Java.
May 6	1	Bro. Matthias Newell, Hilo, Hawaii.
May 11	10	U. S. Experiment Station, Honolulu.
May 17	12	Director, Public Gardens, Jamaica.
June 5	2	Gerrit P. Wilder, Honolulu.
June 7	5	Gerrit P. Wilder, Honolulu.
June 21	2	Gerrit P. Wilder, Honolulu.
July 5	11	Gerrit P. Wilder, Honolulu.
July 14	1	Botanic Gardens, Buitenzorg, Java.
July 14	2	Q. Q. Bradford, Formosa.
July 19	27	Gerrit P. Wilder, Honolulu.
July 21	8	Arnold Arboretum, Jamaica Plain, Mass.
July 23	1	Edward M. Ehrhorn, Honolulu.
Sept. 7	7	Botanic Gardens, Dominica.
Sept. 18	1	Mrs. Dora Isenberg, Lihue, Kauai.
Sept. 28	1	Director Public Gardens, Jamaica.
Sept. 30	4	Capt. E. E. Ropes, Die Lanel, Florida.
Oct. 4	10	Edward M. Ehrhorn, Honolulu.
Oct. 19	4	Hon. S. B. Dole, through Gerrit P. Wilder, Honolulu.
Nov. 18	1	Bro. Matthias Newell, Hilo, Hawaii.
Nov. 21	5	Tokyo Plant and Seed Co., Tokyo, Japan.
Dec. 6	1	T. Inomura, Koshun, Formosa, Japan.
Dec. 19	1	Edward M. Ehrhorn, Honolulu (seed from Peru).
Dec. 20	1	Mrs. Gilbert, Honolulu.
Dec. 27	8	Government Botanic Gardens, Koshun, Formosa.
Dec. 27	1	Government Botanic Gardens, Buitenzorg, Java.

1912.		No. Pkgs.	
Jan.	4	50	Botanic Gardens, Buitenzorg, Java, through Mrs. F. J. Green, Honolulu.
Jan.	15	6	Gerrit P. Wilder, Honolulu.
Jan.	26	5	Arnold Arboretum, Jamaica Plain, Mass.
Jan.	27	26	Assint College, Assint, Egypt.
Mar.	5	8	Jardin Botanique de Saizon, Java.
Mar.	7	9	Government Botanic Gardens, Koshun, Formosa.
Mar.	15	16	Dr. H. L. Lyon, H. S. P. A., Honolulu.
Mar.	24	5	Dr. H. L. Lyon, H. S. P. A., Honolulu.
June	14	15	Bureau of Forestry, Manila.
July	7	5	H. S. P. A., Honolulu.
Aug.	6	1	Gerrit P. Wilder, Honolulu.
Aug.	6	1	Mrs. Foster, Honolulu.
Aug.	8	1	H. S. P. A., Honolulu.
Oct.	10	2	L. Lewton-Brain, Director of Agriculture, Federated Malay States.
Oct.	12	1	Dr. H. L. Lyon, H. S. P. A., Honolulu.
Oct.	19	2	Dr. H. L. Lyon, H. S. P. A., Honolulu.
Oct.	28	4	W. E. Shaw, Cuba.

PLANT DISTRIBUTION.

DISTRIBUTION OF PLANTS FROM GOVERNMENT NURSERY AND MAKIKI STATION.

1911	In seed boxes	In boxes transplanted	Pot grown	Totals
Sold: Regular Distribution	**35,900**	**9,823**	**10,184**	**55,907**
Gratis: Arbor Day		**500**	**11,008**	**11,508**
" Homesteaders and others.	**95,350**	**6,823**	**2,300**	**104,473**
" Military Posts		**2,000**	**4,000**	**6,000**
" Public and Private Schools and churches		**2,200**	**500**	**2,700**
" Molokai Settlement and Cable Station Midway..	**64,000**	**1,000**	**541**	**65,541**
" Improvement Clubs and Street Planting		**1,267**	**1,000**	**2,267**
	195,250	**23,613**	**29,533**	**248,396**
Special Plantation Orders	**338,000**	**11,000**	**.....**	**349,000**
Grand Total	**533,250**	**34,613**	**29,533**	**597,396**

1912	In seed boxes	In boxes transplanted	Pot grown	Totals
Sold: Regular Distribution	10,600	4,570	17,474	32,644
Gratis: Arbor Day		500	13,145	13,645
" Homesteaders and others.	29,000	5000	3,600	37,600
" Military Posts		5,500	3,640	9,140
" Public and Private Schools and Churches		2,492	2,760	5,252
" Molokai Settlement and Cable Station, Midway..	9,250	2,400	6,000	17,650
" Improvement Clubs and Street Planting		2,000	3,143	5,143
	48,750	22,462	49,762	120,974
Special Plantation Orders	624,000	35,400	7,330	666,730
Grand Total	672,750	57,862	57,092	787,704

It will be seen by the foregoing tables that the distribution of trees to the general public and also to plantation companies and other corporations has been larger this year than any previous year in the history of the Nursery. In general we are led to believe that a great deal better use is being made of the trees that are distributed from the Nursery than in previous years. The examples which have come under the writer's personal observation are the homesteaders, the military posts and the house-lot planting. In most instances the trees have been well planted and cared for.

Special mention ought to be made in regard to the planting that has been done at Fort Ruger through the efforts of Major and Mrs. Timberlake. From a heap of dry rocks destitute of any vegetation save a few scrub bushes of lantana, Fort Ruger is fast becoming one of the beauty spots of Honolulu. Those in charge certainly deserve great credit for their work.

The homesteaders are beginning to realize the value of trees on their homesteads and many inquiries are continually coming in regarding the best trees to plant for firewood, windbreaks and other purposes.

The demand for ornamental trees for gardens, and for street and road planting has been large. For such purposes pot-grown seedlings should be used, which insures a good root system and also reduces to a minimum the danger of losing any trees in the transplanting. Terra Cotta pots are generally used for this purpose, although lately we have been experimenting with the damaged tin cans thrown away by the people at the Pineapple Cannery and find that the cans make excellent pots for trees.

A machine was designed and made at the Nursery for cutting out the ends of the cans and we find that this machine is a great saving in labor as compared with the small hand cutter.

The shipping of plants in crate form has been found to work well. An upright frame for placing the boxes in while the laths are being nailed on the corners is another labor-saving device which we planned and built at the Nursery. One man with the frame can do the work of two without it.

Propagating Trees for Plantation Companies and Other Corporations.

The propagating of trees in large quantities for plantation companies and other corporations was started about two years ago. Previous to that time we managed to supply the trees wanted, with the regular men employed by the Board. Owing to the great increase in orders coming from companies and corporations we found it impossible to keep up the work and continue the regular distribution, which was also increasing, without the help of more men. The matter was brought to the attention of the then President and Executive Officer of the Board, Mr. Marston Campbell, who after consulting with the members of the Board, decided to continue the growing of trees in large quantities for plantation companies and other corporations with the understanding that the companies and corporations shall pay the cost of labor and material in supplying the required seedlings. The above plan has worked well and there is no doubt but that it has been the means of adding many thousands of trees to the barren districts of the Islands.

The majority of the trees so ordered are shipped in the seed boxes, ready to transplant into other boxes or pots. The boxes are nailed together with laths in crate form with three or four together. A number of orders of from 1000 to 12,000 have been received for trees in transplant boxes ready to set out. These are crated in the same manner as the seedlings.

REALIZATIONS.

During the years 1911 and 1912 there has been collected and deposited with the Treasurer of the Territory as a government realization the sum of $1126.90. In addition to this there is also the sum of $2955 on special deposit for the use of the Board.

The amount is itemized as follows:

1911	Sale of plants Government Nursery, Honolulu	$ 405.60
	Sale of Seed, Government Nursery, Honolulu	9.15
	Sale of plants, Homestead Nursery, Kauai, by W. D. McBryde	150.00
	Sale of Wood from Tantalus	48.00

Division of Animal Industry.

Sale of one yellow mare	125.00
Payment for use of Quarantine Station	35.50
	$ 773.25

Payment by the Hawaiian Development Co. for timber cut in Puna Hawaii, Under logging license. Deposited with the Treasurer as a special fund for the use of the Board	$2955.00

1912	Sale of plants, Government Nursery and Makiki	$ 189.40
	Sale of tree labels	1.00
	Sale of Wood from Tantalus	105.00

Division of Animal Industry.

Use of Quarantine Station	35.25
Sale of Manure	23.00
	$ 353.65

OTHER WORK.

Nursery Grounds.

One regular man with the aid of two prisoners has been labor enough to keep the grounds in fairly good condition and also at times to assist in other work. We are again indebted to Sheriff Henry for the use of the two prisoners and hope that this help will be continued. Many people take advantage of the open park portion of the grounds for rest and recreation.

The sidewalk running along the King Street side of the grounds is sadly in need of a new curb. Stone curbing is laid on both Keeaumoku and Young streets and there was at one time a wooden curbing on the King Street side but it has practically all rotted away.

Advice and Assistance.

The work under this heading includes the giving of advice in regard to the propagating, planting, pruning and care of trees. Numerous calls are made at the Nursery for advice on those subjects. Requests to visit places in and around the city for the purpose of giving advice and assistance average from two to five visits a week.

Congressional Vegetable Seed and Year Books.

During the month of December, 1911, we received from Washington, D. C., through Hon. J. K. Kalanianaole, Delegate to Congress, 10,000 packages of Congressional Vegetable seed and 300 packages of flower seed. The consignment received in December, 1912, contained about the same number of packages. The demand for vegetable and flower seed is increasing and the supply for 1912 was all distributed several months before we received the supply in December, 1912, intended for 1913. This seed is sent out to public and private schools, homesteaders and others all over the islands.

Copies of the Year Book of the U. S. Department of Agriculture, also sent by the Delegate, are distributed annually to a carefully made up list of persons throughout the Islands. Seven hundred and fifty books is the quota received.

Experimental Garden, Makiki.

Since our last biennial report we have found it necessary to enlarge the quarters. The old iron roofing taken from the office building at the Nursery on King Street was used for this purpose. An additional shed for storing pots, box shooks, etc., has been added to the buildings. A building 60 feet long by 24 feet wide has taken the place of the old potting shed and tool house. In this building the bins for holding soil, sand, manure, tin cans and pots of different sizes for potting of plants are conveniently arranged. The soil sterilizer is also under the same roof, with sufficient space for mixing and preparing soil. The additions and improvements to buildings have proved to be of great benefit in many ways. It would have been almost impossible to fill a number of the large orders from the plantation companies without this additional room. The work was all done by our regular men. The men at the Nursery assisted as much as possible. All of the soil and sand used at the Garden as well as at the Nursery for propagating trees is mixed and sterilized here. With the addition of a propagating house similar to the two at the Nursery we would have the best of facilities here for propagating plants in large quantities.

Basket Willow.

For the past two years the Garden has been used principally for propagating plants, some of which deserve special mention.

The Willow cuttings brought from Portugal about three years ago by Dr. L. R. Gaspar and handed to us by the Honorable A.

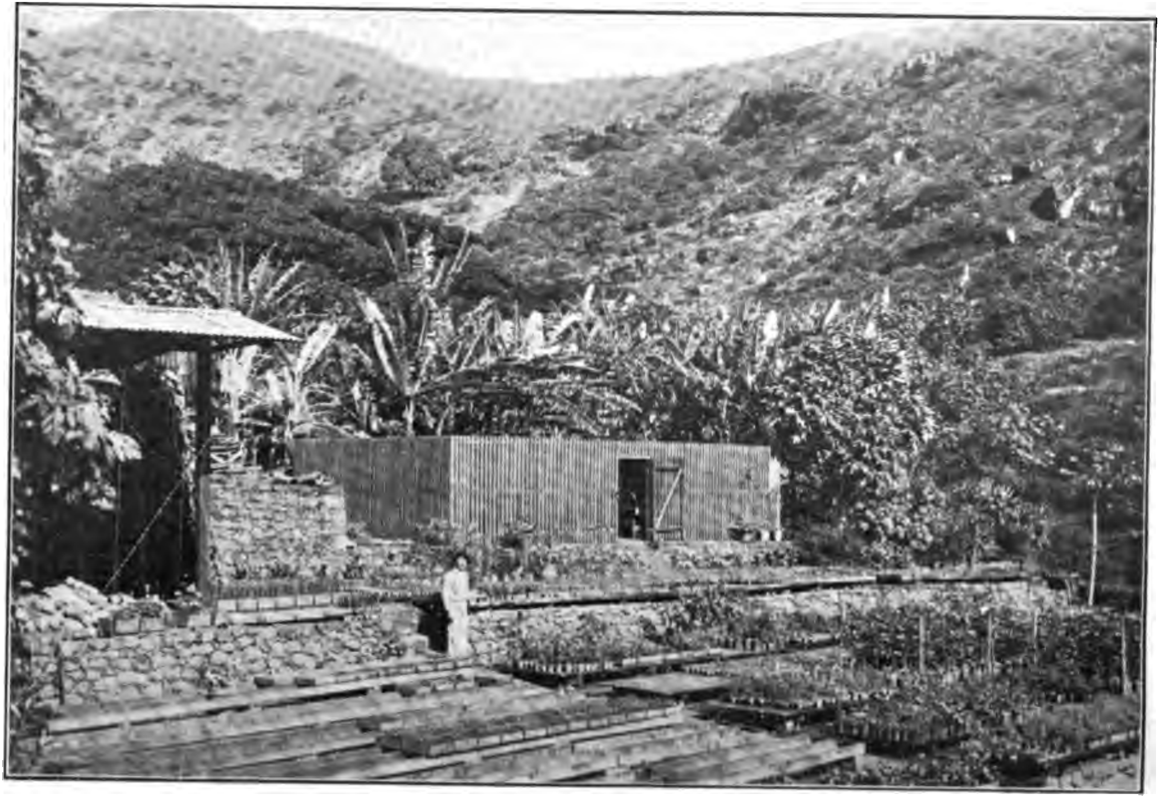


Plate 15. **Experiment Garden in Makiki Valley.**
Benches to the right hold new plant introductions.

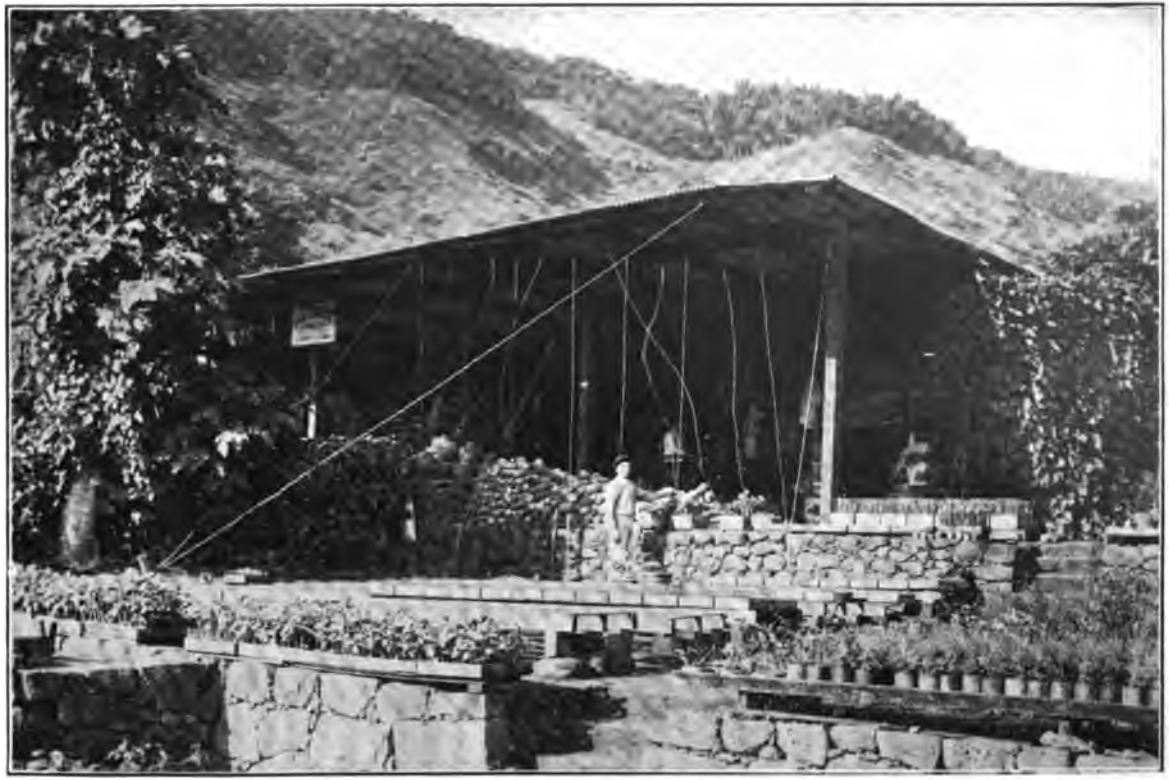


Plate 16. **Potting Shed, Soil Sterilizer and Seedling Benches. Makiki Station.**

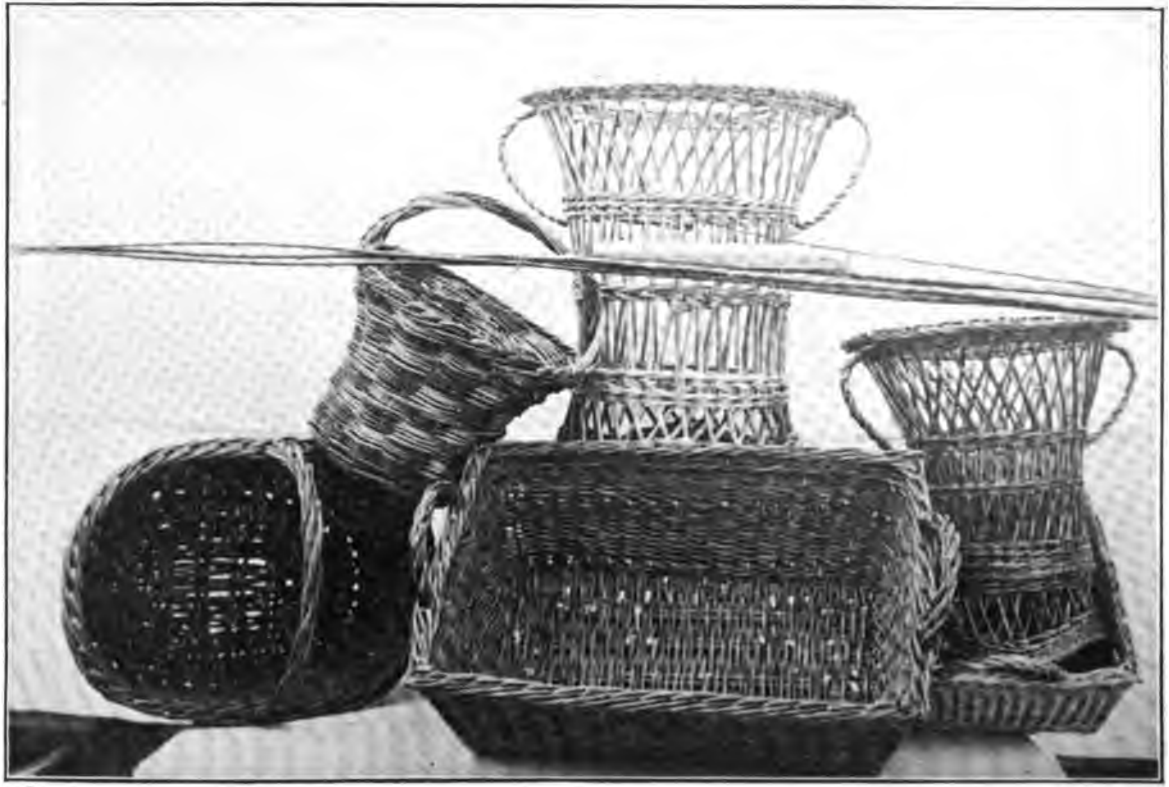


Plate 17. Willow Baskets Made from Plants Grown at the Makiki Experiment Garden.

de Souza Canavarro, Consul General for Portugal, have done exceedingly well. Half a dozen baskets of different shapes and sizes were made from the cuttings taken off during the month of February, 1912. These baskets can be seen at the Government Nursery. There were also a quantity of cuttings taken off for distribution.

We will have about 2000 plants ready for distribution by the end of March, 1913. In sections where there is plenty of moisture and especially along the edges of streams the growing of the basket willow for basket making should prove to be paying industry.

The Giant Bamboo, imported by Mr. Gerrit P. Wilder, is doing very well and without doubt will prove to be a valuable introduction.

Another tree introduced by Mr. Wilder which so far is doing very well is a species of Juniper. The trees are growing well and looking very healthy. A quantity of other trees introduced by Mr. Wilder are doing well, some of which have already been distributed to people on different parts of the Islands.

Tantalus Forest.

With the exception of a number of trees that have died in the lower part of the forest during 1912, the condition in general is good. The trees that died were cut down and removed as soon as possible, the total cordage being 125. In the upper part of the forest the trees are healthy and growing well. Owing to the thick crop of honohono and air plant that is fast covering the floor of the forest, the danger of fires starting is reduced to a minimum.

The Ranger, David Kapihi, has kept the two trails running through the forest clear, also the one running down to the bottom of Makiki Gulch, which starts opposite the old quarters and nursery. He has also kept watch and patrolled the forest in search of stray animals and people who at times trespass in the forest and cut honohono and sometimes trees.

Respectfully submitted,

DAVID HAUGHS,
Forest Nurseryman.

List of District Fire Wardens.

Following is a list of the District Fire Wardens, with their respective Districts:

CHIEF FIRE WARDEN.

RALPH S. HOSMER.

Superintendent of Forestry, ex officio.

DEPUTY FIRE WARDEN AT LARGE.

DAVID HAUGHS.

In and for the Territory of Hawaii.

DISTRICT FIRE WARDENS.

KAUAI.

A. MENEFOGLIO.

In and for Wainiha Valley, District of Halelea.

W. F. SANBORN.

In and for the District of Halelea, excepting Wainiha Valley.

J. R. MYERS.

GEORGE HUDDY,

Assistant District Fire Warden.

In and for the District of Koolau, excepting the land of Anahola.

....

In and for the portion of the Districts of Koolau and Puna, extending from the land of Anahola to the land of Olohena, inclusive.

F. WEBER.

In and for the portion of the District of Puna, south of and including the land of Wailua.

REV. J. M. LYDGATE.

In and for that portion of the district of Kona, formerly known as the District of Koloa.

FRANCIS GAY.

In and for that portion of the District of Kona, lying between and including the Waimea, Poomau and Kauaikanana Valleys on the west and the Hanapepe Valley on the east.

AUGUSTUS F. KNUDSEN.

In and for the District of Na Pali and that portion of the District of Kona, formerly known as the District of Waimea, lying to the west of the Waimea, Poomau and Kauaikanana Valleys.

OAHU.

ANDREW ADAMS.

In and for the District of Koolauloa.

FRANK PAHIA.

In and for that portion of the District of Koolaupoko, extending from the Koolauloa District line to the land of Heeia.

....

In and for that portion of the District of Koolaupoko, extending from and including the land of Heeia to the land of Kailua.

JOHN HERD.

In and for that portion of the District of Koolaupoko, extending from and including the land of Kailua to Makapuu Point.

CHARLES H. BAILEY.

In and for that portion of the District of Kona, extending from Makapuu Point to Palolo Valley.

JOSEPH K. KAPONO.

In and for Palolo Valley District of Kona.

C. MONTAGUE COOKE.

In and for Manoa Valley, District of Kona.

W. M. GIFFARD.

In and for that portion of the District of Kona, lying between Pauoa and Manoa Valleys.

G. H. MOORE.

In and for Pauoa and Nuuanu Valleys, District of Kona.

WALTER F. DILLINGHAM.

In and for that portion of the District of Ewa lying to the West of the main government road.

JAMES GIBB.

In and for that portion of the District of Ewa, lying between the lands of Moanalua and Waiawa.

....

In and for that portion of the District of Ewa, lying to the East of the main government road between the northern boundary of the land of Manana and the Kaukonahua gulch.

W. M. TEMPLETON.

In and for that portion of the District of Waialua, lying between the Kaukonahua and Helemanu gulches.

....

In and for that portion of the District of Waialua, lying to the north of the Helemanu gulch.

F. MEYER.

In and for that portion of the District of Waianae lying to the West of the Waianae Mountains.

MOLOKAI.

JAMES MUNRO.

In and for that portion of the Island of Molokai lying to the West of Wailau Valley and the land of Mapulehu.

C. C. CONRADT.

In and for that portion of the Island of Molokai including and lying to the East of Wailau Valley and the land of Mapulehu.

LANAI.

GEORGE C. MUNRO.

In and for the Island of Lanai.

MAUI.

L. WEINZHEIMER.

In and for the District of Lahaina.

DAVID T. FLEMING.

In and for the District of Kaanapali.

H. B. PENHALLOW.

In and for the District of Wailuku.

H. A. BALDWIN.

In and for the district of Hamakuapoko and the west half of the District of Hamakualoa.

W. F. POGUE.

In and for the District of Koolau and the east half of the District of Hamakualoa.

JOHN CHALMERS.

In and for the District of Hana.

....

In and for the District of Kipahulu.

ALIKA DOWSETT.

In and for the Districts of Honuaula and Kahikinui.

L. VON TEMPSKY.

In and for the Districts of Kula and Kaupo.

HAWAII.

G. C. WATT.

In and for that portion of the north half of the District of Kohala, extending from the land of Kaauhuhu to the Hamakua District line.

SAM P. WOODS.

In and for that portion of North Kohala, extending from the northern boundary of the land of Kawaihae I to and including the land of Kaauhuhu.

SAM M. SPENCER.

In and for the District of South Kohala.

AUGUST AHRENS.

In and for the western part of the District of Hamakua, extending to the boundary of the land of Paauhau.

ALEXANDER SMITH.

In and for that portion of the District of Hamakua, extending from the western boundary of the land of Paauhau to the boundary of the land of Kukaiau.

ALBERT HORNER.

In and for that portion of the District of Hamakua, extending from and including the land of Kukaiau to the Hilo District line.

JOHN M. ROSS.

In and for that portion of the District of Hilo, extending from the Hamakua District to the land of Makahanaloa.

JOHN T. MOIR.

In and for that portion of the District of Hilo, extending from and including the land of the Makahanaloa to the land of Kikala.

JOHN A. SCOTT.

In and for that portion of the District of Hilo, extending from the Puna District line to and including the land of Kikala.

JOHN WATT.

In and for the District of Puna.

WILLIAM G. OGG.

In and for that portion of the District of Kau, extending from the Puna district line to and including the land of Punaluu.

CARL WOLTERS.

In and for that portion of the District of Kau, extending from the land of Punaluu to the Kona District line.

R. VON S. DOMKOWICZ.

In and for that portion of the District of Kona, extending from the Kau District line to and including the land of Kaapuna.

T. C. WHITE, *Acting*.

In and for that portion of the District of Kona, extending from the land of Kaapuna to and including the land of Hookena.

JOHN D. PARIS.

In and for that portion of the District of Kona, extending from the land of Hookena to and including the land of Kaawaloa.

T. C. WHITE.

In and for that portion of the District of Kona, extending from the land of Kaawaloa to and including the land of Kahaluu.

JOHN A. MAGUIRE.

In and for that portion of the District of Kona, extending from the land of Kahaluu to the Kohala District line.

Forest Ranger.

DAVID KAPIHE.

In and for that section of the District of Kona, Island of Oahu, bounded on the east by Manoa Valley, on the north by the Konahuinui Mountain Range, on the west by Nuuanu and Pauoa Valleys, and on the south by the makai edge of the Eucalyptus forest, the Makiki Park and the mauka boundary of the Judd land in Makiki and Manoa.

DISTRICT FORESTERS.

The names of the following gentlemen are borne on the rolls of the Board of Agriculture and Forestry as District Foresters. Those marked with a star (*) have been appointed Special Ter-territorial Police Officers to enforce the terms of the Wild Bird Law, Act 104 of the Session Laws of 1907:

Kauai.

*Albert S. Wilcox, J. R. Myers, *F. Weber, Edward Broadbent, Rev. J. M. Lydgate, *Walter D. McBryde, *Francis Gay, *Augustus F. Knudsen.

Oahu.

*Andrew Adams, *L. L. McCandless, *John Herd, *Paul R. Isenberg, *Walter F. Dillingham, W. W. Goodale.

Molokai.

*James Munro, *C. C. Conradt.

Lanai.

Geo. C. Munro.

Maui.

.L. Weinzheimer, H. B. Penhallow, *H. A. Baldwin, *W. F. Pogue, *L. von Tempsky, Dr. J. H. Raymond, D. T. Fleming.

Hawaii.

*G. C. Watt, *A. W. Carter, *A. Ahrens, *John M. Ross, *John A. Scott, *John Watt, *Julian Monsarrat, *Geo. C. Hewitt, R. Von S. Domkowicz, W. R. Castle, *John D. Paris, *John A. Maguire.

Report of the Consulting Botanist.

Honolulu, T. H., December 31, 1912.

The Board of Commissioners of
Agriculture and Forestry,
Honolulu, Hawaii.

GENTLEMEN:—I beg to present a brief report of the work accomplished during the period from January 1, 1911 to September 1, 1911, after which my connection with the Forestry Division as an active staff-member was severed.

Up to April, 1911, the writer was engaged in identifying plants collected on previous exploring trips,. but especial mention must be made of the work in monographing one of our largest and most interesting plant families, namely Campanulaceae, with especial reference to the tribe Lobelioideae. In order to make a thorough and exhaustive study of this tribe which seemed to be in an eclipse, type material was found to be necessay in order to bring this huge task to a successful completion. Letters were written to the Directorates of the Berlin, Paris and Vienna Museums as well as to Harvard (Gray Herbarium) asking for the loan of such type and other material of the tribe Lobelioideae as was in their possession.

All these requests were kindly complied with and the material promptly forwarded. These very valuable collections were of inestimable assistance in determining our plants and enlarging upon their original descriptions and making certain the determination of new species.

All the type material was photographed and is expected to be published together with the numerous plates of new species in a forthcoming monograph by the writer. At about the same time the writer commenced writing the manuscript from the copious notes compiled in the field for his forthcoming book on the Indigenous Trees of the Hawaiian Islands.

EXPLORATION ON THE WINDWARD SIDE OF HALEAKALA FROM KAILUA, MAUI, TO HANA, MAUI.

During the month of April the writer made a field trip to the Volcano of Kilauea on Hawaii to explore the neighboring districts and slopes of Mauna Loa as far as possible at that time. His attention was called to a certain kipuka, or oasis as it may be termed, by Mr. L. A. Thurston, who had discovered this most interesting parcel of land containing 56 acres with more than 40 species of trees some of which were new and unique.

This kipuka is situated at an elevation of 4000 feet, about three miles from the Volcano House. Nowhere in the Territory, with the exception of few places on Hawaii and Maui, did the writer find such an interesting tree flora as covers these 56 acres, where virgin soil abounds, black, and rich and without a sign of rocks or lava.

The fact that Puaulu remained so long undiscovered may be attributed to the vast aa lava fields which surround this kipuka and hide it completely from view, and more so on account of the huge Koa forest which has taken possession of the ancient lava flows which encircle this virgin parcel of land.

Rich collections were made and several new species discovered; among them a new genus of trees, which the writer called *Hibiscadelphus,* and described with some others in a botanical bulletin issued by your Board, September, 1911.

After spending a few weeks on Hawaii the writer joined a party consisting of Messrs. Hosmer and Curran at Mr. von Tempsky's, Makawao, Maui, and proceeded across the forest from Olinda to Mr. Pogue's at Kailua, Maui, with the view of looking into the dead forest there.

Taking advantage of the occasion offered, the writer stayed several weeks longer exploring the whole country from Kailua to Hana, especially the valleys of Waikamoi, Puohaokamoa, Honomanu, Keanae, and the forests back of Nahiku. At Honomanu, at an elevation of 3000 feet. the writer discovered a new species of palm which is now being described with others by Dr. O. Beccari of Florence, Italy; a translation of whose work on these palms will appear in the writer's tree book. In collecting, special attention was paid to the tribe Lobelioideae, numerous members of which were then in flower.

After a sojourn of several weeks, the writer returned to Honolulu; shortly before his departure from Maui, however, he secured one of the largest Silverswords from Haleakala crater, weighing 96 pounds, for the Promotion Committee, where it is on exhibition, together with some photographs taken by the author and representing scenes from Maui.

After an illness of over six weeks the writer again visited Kilauea, Hawaii, in company with Mr. W. M. Giffard. This time more for recuperating than collecting. However, botanical material was secured, especially of such plants of which complete material had not been collected previously, this having been the summer season when everything was either in flower or fruit.

In September a bulletin was issued by the Board describing new species of trees discovered by the writer, with an original diagnosis of the interesting *Alectryon macrococcus* Radlk. by Dr. Radlkofer of Munich, Bavaria, with additional description of the male flowers, by the writer, which up to that time were unknown.

Plate 18. **The Koko or Akoko.**
A Hawaiian Rubber-producing Tree.

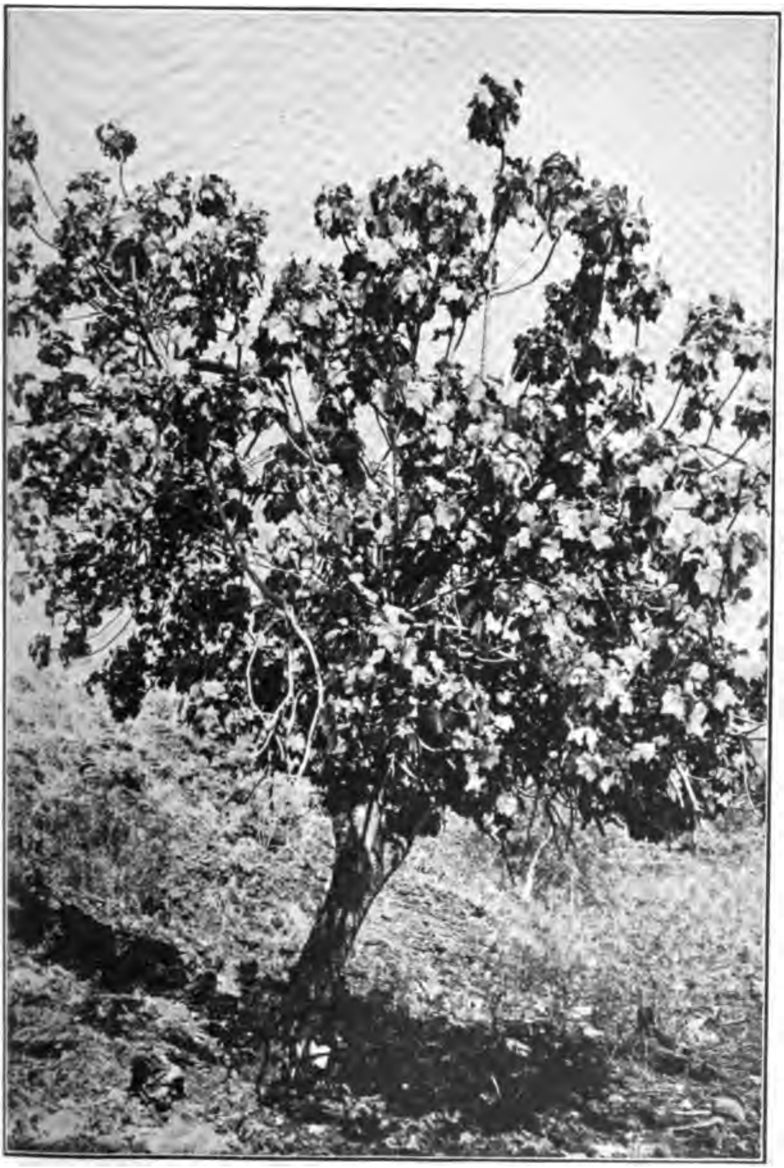


Plate 19. Kokia Rockii Lewt. Kokia.
One of the healthy cotton trees.

Plate 20. **Kokia Rockii** Lewt.
The majority of the trees are in a dying condition.

TRANSFER OF THE HERBARIUM TO THE COLLEGE OF HAWAII.

Owing to lack of funds, the Board found it advisable to discontinue the botanical work of the Department of Forestry carried on by the writer, though, in order that the valuable material collected during a period of over three years should not be left undetermined and in such shape as would be practically useless to future workers, it was deemed best to transfer the whole herbarium to the College of Hawaii where the writer could continue his researches and bring the whole work to a satisfactory conclusion.

Under the new auspices the writer has made several field trips and enriched the herbarium by several thousand sheets. The grasses were worked up by Dr. Hackel of Austria, the rushes by the Rev. George Kukenthal of Coburg, the lichenes by Dr. A. Zahlbruckner of Vienna and the palms by Dr. O. Beccari of Florence. The writer takes this opportunity to express the thanks of the Forestry Division as well as his own to the above gentlemen, who are all authorities in their respective fields, for their valuable service.

PLANT PROTECTION.

Mr. Fairchild, Agricultural Explorer in charge of the Bureau of Plant Industry, Department of Agriculture, Washington, D. C., whose attention had been called to the writer's discovery of a species of Gossypium from Mt. Hualalai, Hawaii, through the writer's last report, entered into correspondence with the latter in regard to collecting of seeds of this rare Hawaiian plant, which he thinks to be of economic importance. He also advised to have these few remaining trees protected from cattle in order to assure their perpetuation for, at least, a few years more to come.

The Territorial Government was in a way powerless to act as the trees are found on private estates, except in one place where they are growing on Government land, at present under lease to Mr. Robert Hind.

Fortunately arrangement could be made with the Bishop Estate and Mr. Robert Hind in regard to the fencing of these rare and valuable trees. Nearly all of them are now fenced and protected from cattle which are very fond of the succulent branchlets and large leaves. The Board of Forestry also contributed $100 toward defraying expenses of fencing. Herbarium samples of these interesting trees were forwarded together with specimens from a related species from Molokai to Mr. Fred Lewton, Curator of Textiles, who described the plants under a new genus "*Kokia*" after its native name *Kokio*.

The type of the genus is *Kokia Rockii* Lewton. His paper, which forms No. 5 of Vol. 60 of Smithsonian Miscellaneous collections, is entitled *Kokia: A New Genus of Hawaiian Trees,* and was issued October 22, 1912; it is illustrated by 5 plates, two of which were furnished by the writer. At the request of Mr. Fairchild, the writer caused seeds of *Kokia Rockii* to be gathered which were forwarded to the Bureau of Plant Industry, Washington, D. C.

DISCOVERY OF A NATIVE HAWAIIAN RUBBER PRODUCING TREE.

While on an official exploration trip at Puuwaawaa, North Kona, Hawaii. one of the richest botanical sections in the Territory, the writer found a species of Euphorbia (*E. lorifolia*) which produced a tremendous flow of latex when bruised or cut. It is a tree of an average height of 20 feet and a trunk of about 10 inches in diameter. It is very abundant and scattered over an area of more than 5000 acres. In certain localities the plants are so thick that it is impossible to ride through them. The ground is covered densely with the young seedlings and thousands upon thousands of plants cover that area. The writer tapped several trees and sent the secured latex to the Chemist of the Hawaii Agricultural Experiment Station at Honolulu.

Mr. Wm. McGeorge and Mr. W. A. Anderson published a paper or press bulletin* on the result of their investigation, to which the writer would refer any one particularly interested in this discovery. Samples of the crude dry material, rubber, resin, etc., were taken by Mr. Anderson to the Rubber Exposition in New York; one firm offered 70c per pound for the crude material. The writer has been told by Mr. R. Hind, on whose leased land the trees are found, that he is now shipping one ton of the crude material to a firm in the East, which is, I believe, for experimental purposes.

COLLECTING OF SEED FOR EXCHANGE PURPOSES.

While on an exploring trip in Kau and South Kona, Hawaii, during the months of December, 1911, January and February, 1912, the writer collected several hundred pounds of seeds of Hawaiian trees, the most noteworthy of which were the following:

---

* **Hawaii Agricultural Experiment Station, Press Bulletin No. 37, "Euphorbia lorifolia, a Possible Source of Rubber and Chicle," by Wm. McGeorge and W. A. Anderson.**

Olopua, Osmanthus sandwicensis.
Alaa, Sideroxylon auahiense.
Hame, Antidesma pulvinatum.
Halapepe, Dracaena aurea.
Hoawa, Pittosporum Hosmeri var.
Lama, Maba sandwicensis.

At Kapua, South Kona, the writer also collected additional wood specimens of 12 native trees, which were not in the collection made previously for the Seattle Fair.

Respectfully submitted,.

J. F. Rock,
Consulting Botanist.

Division of Entomology.

Report of the Superintendent of Entomology.

Honolulu, Hawaii, December 31, 1912.

The Board of Commissioners of
Agriculture and Forestry,
Honolulu, Hawaii.

GENTLEMEN:—I have the honor to submit herewith the bienniel report of the Division of Entomology covering the work of this Division from January 1st, 1911, to December 31st, 1912.

The principal work of the Division during the above period consisted of the quarantine inspection of agricultural and horticultural products arriving in the Islands by steamers and sailing vessels from foreign countries and the mainland, the inter-island inspection, which work was started on July 1, 1911, and laboratory work performed in co-operation with the office of the Fruit Fly Control.

The importance of the quarantine inspection has been clearly demonstrated ever since it began and this year's work, when compared with the work done during 1909-1910. will show a material increase in our labors. During the biennial period of 1911-1912 there has been a decided increase in all shipping lines coming to the Islands from foreign countries and the mainland and naturally the work of this Division has proportionately increased.

STAFF.

At the beginning of the present biennial period the staff of the Division of Entomology consisted of the Superintendent and Chief Inspector, and one Assistant Inspector, Mr. D. B. Kuhns. Miss Louise Gulick was employed as Laboratory Assistant for four months to assist in the breeding experiments of infested fruits submitted by the Director of the Fruit Fly Control. She was obliged to return to her studies at the College of Hawaii and her work was taken up by Miss Maude Dawson, who continued it for two and a half months. The height of the fruit season having then terminated there was no longer any reason for keeping up the work.

Owing to the frequent simultantous arrival of steamers, it became necessary to procure an Assistant Dock Inspector and Mr.

Isaac Kahele was engaged on August 1st, 1912, to assist in preventing the landing of uninspected fruits and plants and other work in connection with quarantine inspection.

On July 1st, 1911, Mr. Arthur E. Carter and Mr. Edward Drew were employed as inspectors for the inter-island inspection. On May 31st, 1912, Mr. Carter resigned and the vacancy was filled by the appointment of Mr. Robert W. Kanakanui.

Brother Matthias Newell has continued as our regular inspector at the Port of Hilo. There has been a marked increase in the arrival of steamers and sailing vessels at this port and there are rumors that within a short time certain steamers arriving direct from the Orient will make Hilo a port of call. In this event it will become necessary to increase the inspection force and install a well equipped office and laboratory there.

Mr. Albert Koebele has held the position of Consulting Entomologist up to June 30th, 1912. All of his time was spent in Europe collecting parasites of the Hornfly. A report of his work follows as an appendix hereto.

The following gentlemen are still acting as honorary inspectors at the various ports on the Islands: Mr. E. Madden, Mahukona, recently appointed in place of the late R. R. Elgin, deceased; Mr. W. O. Aiken, Kahului, Maui; Mr. W. D. McBryde, Koloa, Kauai; Dr. W. D. Deas, Hana, Maui; Captain C. F. Turne, Kaanapali, Maui, and Mr. G. C. Munro, Keomoku, Lanai.

WORK PERFORMED.

The inspection of fruits, plants and vegetables in freight, express packages, post office matter and baggage has so increased during the biennial period, especially during 1912, that at times it has been a severe tax on the two men to do the work. Realizing the great danger in handing shipments short handed, the Board of Commissioners of Agriculture and Forestry in July, 1912, granted my request for the appointment of a Dock Assistant to help guard the gangway of vessels while in port and to watch all freight and express matter on the docks pending inspection. On August 1st I appointed Mr. Kahele, who, being an inexperienced man in inspection work, found it very difficult in the beginning but as his duties were more in the line of a watchman he soon became proficient. This appointment was a good step towards insuring the inspection of packages containing fruits and plants which passengers often carry when leaving a vessel. As an illustration of the importance of having a watchman at the steamers while in port, I may mention that on one occasion we took from passengers plants brought from Japan, the soil of which contained the grubs of a very destructive beetle closely related to the Japanese beetle, but larger. The dock assistant is kept on duty at the gangway as long as the steamer is in port and all packages that contain fruit or plants are held by him after the Custom Officer has inspected them for his official purposes. I must again commend the sincere and hearty co-operation which exists between the Custom Officials and this Division.

In addition to Mr. Kahele's services I have at times been compelled to call in the inter-island inspectors to aid in the quarantine inspection work on account of the arrival of several steamers on the same day. These men could watch the extra boats and their cargoes while the two regular inspectors were occupied with other inspection work. Owing to changes in schedules by some of the steamship companies, there have been as many as four boats arriving simultaneously. During the two years the Superintendent and his assistants have boarded at Honolulu and Hilo 991 vessels, finding vegetable matter on 556 of these. As compared with the biennial period of 1909-1910, there is an increase of 88 vessels boarded and 72 vessels carrying vegetable matter. In 1911, 204,059 packages, and in 1912, 280,930 packages of fruits, vegetables and plants have been inspected, making a grand total of 484,989 packages in all. As compared with the biennial period of 1909-1910 there is a large increase in these shipments. This amounts to 97,928 packages, or nearly 25 per cent.

Owing to the rigid inspection enforced at this port and the improved County inspection and compulsory fumigation and spraying of orchards in California and other Coast states, there has been a noticeable improvement in all fruit shipments from the Mainland.

The following tables give a summary of the inspection work performed at Honolulu and Hilo:

MONTHLY INSPECTION AT HONOLULU, 1911.

1911	Vessels Inspected	Vessels carrying Vegetable Matter	PASSED		FUMIGATED		BURNED		RETURNED				Fruits and Vegetables	TOTAL INSPECTED	
			Lots	Parcels	Lots	Parcels	Lots	Parcels	Lots	Parcels	Seeds	Plants		Lots	Parcels
Jan.	38	19	916	12,704	13	388	67	67	..	..	40	404	12,715	996	13,159
Feb.	24	14	757	10,635	13	53	29	29	..	..	104	156	10,457	799	10,717
Mar.	34	22	1,281	20,945	17	46	49	51	..	..	57	118	20,867	1,347	21,042
Apr.	36	19	597	7,284	12	23	29	128	..	..	30	186	7,219	638	7,435
May.	31	20	1,123	12,194	10	53	17	17	..	..	42	88	12,134	1,150	12,264
June.	26	16	676	9,416	14	17	34	64	4	25	65	86	9,371	728	9,522
July.	34	15	864	14,727	5	9	9	21	1	1	160	42	14,556	879	14,758
Aug.	32	16	776	12,283	3	4	17	17	..	..	11	25	12,268	796	12,304
Sept.	32	21	1,053	21,201	7	9	19	20	..	..	81	36	21,113	1,079	21,230
Oct.	27	19	850	20,457	5	5	39	39	..	..	41	60	20,400	894	20,501
Nov.	34	17	798	15,720	10	15	20	51	..	..	219	75	15,492	828	15,786
Dec.	32	18	949	21,941	36	842	38	496	..	..	71	1,241	21,967	1,023	23,279
Total	380	216	10,640	179,507	145	1,464	367	1,000	5	26	921	2,517	178,559	11,157	181,997

MONTHLY INSPECTION AT HONOLULU, 1912.

1912	Vessel Inspected	Vessels carrying Vegetable matter	PASSED		FUMIGATED		BURNED		RETURNED				Fruits and Veg etables	TOTAL INSPECTED	
			Lots	Parcels	Lots	Parcels	Lots	Parcels	Lots	Parcels	Seeds	Plants		Lots	Parcels
Jan.	27	20	610	17,809	38	420	25	176	..	..	90	618	17,697	673	18,405
Feb.	40	24	683	21,622	14	410	16	38	..	..	79	543	21,448	713	22,070
Mar.	35	20	541	14,435	9	459	25	57	..	..	120	526	14,305	575	14,951
Apr.	36	24	629	14,238	11	169	28	122	..	..	80	300	14,149	668	14,529
May	35	20	541	8,709	16	165	27	166	..	..	165	232	8,643	584	9,040
June	32	19	793	12,972	10	179	28	89	..	..	68	261	12,911	831	13,240
July	38	21	1,054	19,850	8	18	27	60	..	..	68	65	19,795	1,089	19,928
Aug.	36	20	1,025	17,200	6	36	27	55	..	..	49	54	17,188	1,068	17,291
Sept.	36	24	1,166	27,593	12	54	26	27	1	14	639	70	26,979	1,207	27,688
Oct.	35	18	1,182	28,473	19	861	43	149	..	..	117	1,115	28,251	1,244	29,483
Nov.	33	22	1,168	27,390	18	328	53	74	..	..	123	495	27,174	1,239	27,792
Dec.	44	21	1,577	37,019	79	2,343	82	99	1	96	133	2,831	36,593	1,739	39,557
Total	427	253	10,981	247,310	240	5,442	407	1,112	2	110	1,731	7,060	245,183	11,630	253,974

MONTHLY INSPECTION AT HILO, 1911.

1911 Month	Vessels Inspected	Vessels carrying Vegetable matter	Passed free from pests	Treated before releasing	Burned	Returned	TOTAL	
							Lots	Pkgs.
January	7	2	1,502	..	..	..	81	1,502
February	9	3	1,329	1	..	10	87	1,340
March	6	3	1,778	..	1	..	109	1,779
April	9	4	1,117	..	..	..	92	1,117
May	7	5	1,310	3	..	..	132	1,313
June	5	3	658	..	..	..	72	658
July	8	4	1,624	..	7	..	125	1,631
August	9	3	1,240	..	..	..	107	1,240
September	9	3	2,055	36	1	..	187	2,571
October	7	3	2,570	..	1	..	135	2,092
November	7	3	2,773	5	..	200	155	2,978
December	9	4	3,839	..	2	..	196	3,841
Total	87	40	21,795	45	12	210	1,478	22,062

MONTHLY INSPECTION AT HILO, 1912.

1912 Months	Vessels Inspected	Vessels carrying Vegetable matter	Passed free from pests	Treated before releasing	Burned	Returned	TOTAL	
							Lot	Pkgs.
January	8	4	2,281	50	..	..	107	2,331
February	8	3	1,606	..	..	..	83	1,606
March	9	2	784	..	..	..	45	784
April	11	4	1,827*	..	5	..	116	1,832
May	9	4	1,506	1	..	..	83	1,507
June	6	4	1,766	..	1	..	127	1,767
July	8	7	1,652	..	..	..	109	1,652
August	6	3	1,116	..	..	..	74	1,116
September	9	3	1,846	1	..	..	137	1,847
October	10	5	2,368	1	..	..	154	2,369
November	7	5	3,247	..	..	..	174	3,247
December	6	5	6,898	..	..	..	325	6,898
Total	97	47	26,897	53	6	..	1,534	26,956

* One vessel had soil as ballast which was thrown overboard.

FRUITS AND VEGETABLES RECEIVED AT HONOLULU DURING 1911.

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Apples	2,435	1,827	2,240	829	526	111	246	1,467	5,342	6,985	4,388	5,106	31,502
Apricots	...	...	...	...	...	266	380	22	...	...	...	...	668
Artichokes	6	14	43	37	44	27	19	10	14	15	15	20	264
Beets	...	...	7	5	33	10	...	4	...	412	1	...	472
Cabbage	70	83	97	11	91	27	25	115	208	236	249	327	1,539
Cabbage (Pake)	19	1	...	...	...	...	...	...	...	...	...	3	23
Canteloupes	...	...	17	...	...	...	...	...	...	...	...	...	17
Carrots	...	...	15	...	...	...	...	...	10	15	10	40	90
Cauliflower	75	104	175	76	139	114	128	103	161	178	117	228	1,598
Celery	63	91	109	57	63	17	67	107	168	169	148	216	1,275
Celery Root	3	31	7	4	1	...	3	1	4	4	6	7	71
Cherries	...	...	...	...	417	892	243	12	...	...	...	...	1,564
Cranberries	...	...	...	..	...	...	...	...	...	4	11	5	20
Asparagus	...	...	11	26	69	42	24	11	4	...	...	...	187
Fruit	3	9	8	...	12	9	30	33	45	31	33	55	268
Garlic	45	60	51	15	84	49	156	92	55	50	78	60	795
Grape Fruit	49	44	153	94	91	49	141	118	140	36	152	179	1,246
Grapes	...	...	...	...	...	2	5	175	1,896	1,898	1,817	769	6,562
Horse Radish	3	3	8	7	10	4	...	3	7	4	7	5	61
Lemons	126	153	422	146	764	358	357	359	606	206	255	421	3,873
Pomegranate	...	...	...	...	...	...	...	...	...	...	36	...	36
Megs	...	...	...	...	...	18	163	139	284	256	106	75	1,041
Rutabagas	...	...	...	...	...	2	...	...	...	...	...	...	2
Nectarines	...	...	...	...	...	...	...	77	12	...	5	...	94
Nuts	2	...	...	...	35	...	...	38	19	31	...	...	125
Onions	597	673	1,452	355	61	812	2,170	1,108	1,630	1,162	1,428	1,533	13,035
Oranges	3,125	2,104	3,330	2,154	4,367	2,161	1,830	998	1,100	1,522	1,110	3,175	26,976
Parsnips	4	8	25	9	12	9	11	5	16	15	12	...	126
Peas	...	...	...	15	33	37	31	25	12	19	12	33	217

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Peaches	...	...	...	...	...	145	856	915	1,474	848	...	6	4,244
Gooseberries	...	...	...	...	...	9	...	...	...	...	...	...	9
Pears	6	2	38	1	...	45	180	717	1,335	417	339	17	3,151
Persimmons	...	...	...	...	...	...	...	...	...	60	241	134	435
Plants	24	38	58	172	71	48	34	19	30	48	58	67	667
Plums	...	...	...	9	...	47	756	875	1,007	348	1	...	3,043
Prunes	...	...	...	...	...	...	...	...	...	45	...	...	45
Quinces	...	...	26	...	...	...	...	...	...	9	19	...	54
Seeds	15	75	35	30	41	33	22	11	48	31	87	36	464
Sprouts	6	21	5	...	77	...	...	1	8	19	25	45	207
Spuds	3,936	4,490	9,617	1,464	4,079	3,372	6,489	4,504	5,330	5,127	4,361	7,850	60,619
Squash	3	1	1	...	...	2	1	...	5	9	8	17	47
Sweet Potatoes	...	...	...	...	13	1	...	...	...	2	...	131	147
Tangarines	495	436	905	110	319	37	...	...	...	...	133	851	3,286
Tomatoes	6	...	...	8	22	...	1	24	2	3	1	...	67
Turnips	12	48	128	34	12	20	54	39	...	90	24	84	545
Trees	4	87	22	2	...	...	...	...	...	1	...	35	151
Vegetables	34	1	28	14	25	2	1	1	49	7	9	14	185
Rhubarbs	3	11	35	22	40	31	21	14	6	2	5	1	191
Total	11,169	10,415	19,068	5,706	11,251	8,808	14,444	12,104	21,008	20,321	15,380	21,630	171,304

FRUITS AND VEGETABLES RECEIVED AT HONOLULU DURING 1912.

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Apples	3,256	3,516	977	1,767	774	343	1,460	2,066	7,519	9,543	8,135	12,078	51,434
Apricots	...	...	...	..	...	426	249	90	...	...	...	...	765
Artichokes	7	17	14	32	22	25	15	10	18	15	8	18	201
Beans	112	...	...	...	...	14	...	...	20	...	...	232	378
Cabbage	77	29	5	26	48	54	238	261	217	254	321	342	1,972
Asparagus	...	...	28	60	45	49	19	2	...	...	...	...	203
Carrots	...	20	25	...	...	...	...	...	...	15	10	...	80
Cauliflower	64	197	168	145	67	148	240	206	224	223	204	362	2,248
Celery	71	106	85	91	1	13	107	162	211	272	223	277	1,613
Celery Root	...	9	5	1	...	...	...	9	7	...	1	3	35
Cherries	...	...	...	...	389	939	410	35	...	...	...	...	1,773
Cranberries	...	1	...	...	...	...	...	...	...	3	14	40	58
Figs	1	...	...	...	2	...	2	...	...	...	...	50	55
Fruit	12	15	5	8	5	6	50	38	21	56	32	505	753
Garlic	33	85	17	79	38	55	65	39	78	106	35	89	719
Grape Fruit	65	97	109	118	93	72	101	102	89	137	88	182	1,253
Grapes	...	...	...	...	...	...	...	526	2,753	1,674	1,176	225	6,354
Horse Radish	...	11	3	8	6	6	4	3	6	6	6	9	68
Lemons	299	442	391	344	248	526	546	442	356	662	494	210	4,960
Herbs	...	...	...	4	...	...	...	...	...	2	1	...	7
Megs	...	1	...	...	...	98	302	238	411	243	14	...	1,307
Nectarines	...	...	...	...	...	...	...	142	...	...	...	...	142
Rhubarb	...	...	24	35	28	44	32	7	4	1	4	18	197
Nuts	...	14	30	1	7	39	20	10	33	23	75	330	582
Onions	1,535	1,470	710	551	262	1,318	2,498	1,405	1,927	2,226	2,165	2,181	18,348
Oranges	3,360	4,228	1,718	2,031	2,000	3,211	2,092	2,012	1,713	1,828	2,675	4,498	31,366
Parsnips	8	16	21	18	11	21	17	15	17	36	15	17	212
Peas	5	1	2	28	23	29	19	8	15	2	3	11	146
Peaches	...	...	...	...	...	430	1,669	1,385	2,123	1,353	278	...	7,238

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Gooseberries	...	...	...	...	...	6	...	...	...	...	...	...	6
Pears	16	...	5	1	...	24	527	787	1,031	876	483	268	4,018
Persimmons	3	...	...	...	...	...	...	...	...	203	549	688	1,443
Plants	62	64	48	64	97	61	43	23	24	53	89	205	833
Plumcots	...	...	...	...	...	...	...	2	...	...	...	...	2
Plums	...	...	...	...	...	252	1,567	1,075	839	185	40	7	3,965
Prunes	10	29	...	...	...	47	38	...	63	23	...	...	210
Quinces	...	...	...	...	...	...	...	...	2	4	4	4	14
Seeds	57	62	88	70	41	62	51	44	64	100	95	102	836
Sprouts	8	18	2	...	...	...	...	...	11	18	17	31	105
Spuds	7,678	9,245	7,652	6,796	3,456	4,483	7,173	5,886	7,123	7,874	9,695	11,706	88,767
Squash	3	3	2	...	...	...	1	...	3	1	5	11	29
Sweet Potatoes	...	2	...	158	...	...	...	...	1	...	...	...	161
Tangerines	498	792	439	370	232	...	...	...	...	...	102	1,483	3,915
Pomegranates	...	...	...	...	...	...	...	...	1	8	40	...	49
Turnips	27	71	116	50	16	34	73	23	40	144	36	41	671
Trees	...	4	1	...	...	...	...	...	...	...	...	140	145
Vegetables	16	37	47	1	2	7	1	2	4	...	20	18	155
Bulbs	22	40	11	23	3	5	5	...	1	11	38	22	181
Total	17,305	20,642	12,758	12,880	8,016	12,846	19,636	17,053	26,969	28,280	27,190	36,402	239,977

FRUITS AND VEGETABLES RECEIVED AT HONOLULU DURING 1911—ORIENTAL CARGO.

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Apples	15	5	...	3	...	6	2	2	1	7	5	3	49
Bulbs	7	...	...	...	...	...	...	...	...	...	...	90	97
Lichee	...	...	...	...	...	...	1	...	...	...	...	...	1
Bulbs—Lily	38	18	30	...	2	2	...	...	...	...	...	...	90
China-roots	...	...	...	...	...	7	2	6	6	...	...	...	21
Caladium	72	87	31	...	...	...	...	...	...	...	...	...	190
Chestnuts	31	1	15	...	27	...	...	...	...	...	...	26	100
Water Chestnuts	183	75	32	58	29	95	63	84	81	27	44	55	826
Fruit	...	...	...	...	...	6	...	...	2	12	...	1	21
Garlic	...	...	...	2	16	22	...	...	1	...	...	1	42
Grape Fruit	...	...	10	14	...	...	1	4	2	...	...	...	31
Ginger	26	8	11	10	2	16	...	2	10	2	9	24	120
Horse Radish	...	1	1	...	...	...	...	...	...	...	...	...	2
Lemons	...	...	...	...	...	2	...	...	1	...	2	...	5
Lily Root	...	...	...	...	...	2	2	2	7	28	24	...	65
Nuts	6	...	...	...	...	...	...	...	...	...	7	137	150
Onions	1,076	...	1,709	1,570	871	300	...	1	1	1	1	...	5,530
Oranges	7	4	21	19	8	12	2	6	3	10	14	16	122
Olives	2	...	...	1	...	...	1	...	...	2	6	13	25
Pomelos	8	1	...	...	...	...	1	...	...	...	2	12	24
Peaches	...	...	...	...	...	...	...	1	...	...	...	...	1
Pepermint Root	...	...	...	...	12	1	...	...	...	...	...	...	13
Pears—Sand	6	13	11	...	5	7	...	5	6	37	16	11	117
Persimmons	...	...	...	...	...	...	...	...	...	...	3	5	8
Plants	376	31	38	12	17	38	8	6	6	5	17	1,139	1,693
Plums	3	...	...	...	...	...	...	...	...	...	...	...	3
Pineapples	...	...	...	...	...	...	...	...	...	...	3	...	3
Quinces	...	...	...	...	5	...	...	...	...	...	...	...	5
Seeds	25	29	22	...	1	32	138	...	33	10	132	35	457

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Sprouts	1	1	...	...	...	...	...	...	...	...	...	...	2
Spuds	...	...	...	...	...	11	3	13	10	...	...	2	39
Sugar Cane	...	...	...	...	...	...	...	...	...	...	1	...	1
Sweet Potatoes	13	7	...	23	15	29	32	18	33	...	1	...	171
Tangerines	29	3	...	37	...	...	1	...	...	...	4	14	88
Taro	...	3	...	...	...	...	3	...	...	...	...	...	6
Trees	...	...	...	...	...	...	...	...	...	6	...	...	6
Vegetables	4	10	2	5	10	3	...	...	...	...	17	2	53
Yams	62	5	4	12	20	96	54	50	19	33	98	63	516
Total	1,990	302	1,974	1,729	1,013	714	314	200	222	180	406	1,649	10,693

FRUITS AND VEGETABLES RECEIVED AT HONOLULU DURING 1912—ORIENTAL CARGO.

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Apples	16	...	5	3	4	2	3	4	5	3	9	6	50
Water Chestnuts	112	100	44	35	54	56	95	63	25	37	30	79	730
Asparagus	...	...	...	...	1	...	1	...	...	...	...	...	2
Beans	...	...	573	...	...	...	...	...	...	...	38	100	711
Cocoanuts	...	1	...	...	...	...	...	...	...	...	...	1	2
Carrots	...	...	...	...	...	...	...	...	...	...	...	15	15
Caladiums	81	303	76	16	...	...	...	...	...	...	...	...	476
Ginger	18	12	5	4	6	22	9	9	2	8	6	42	143
Chestnuts	51	44	2	5	...	...	...	1	...	3	8	55	168
Fruit	...	...	1	...	1	...	...	1	3	1	...	...	7
Garlic	1	...	...	13	15	15	11	2	2	...	1	1	61
Grape Fruit	...	...	...	...	...	...	...	...	...	...	2	4	6
Horse Radish	...	3	...	2	...	2	1	1	1	...	1	1	12
Lemons	1	...	...	...	...	...	...	...	...	...	...	1	2
Olives	11	6	7	...	7	...	5	...	...	...	3	4	43
Yams	58	32	15	26	42	39	82	70	33	39	40	124	600
Nuts—White	12	14	29	1	9	...	1	...	...	9	7	15	97
Onions	111	401	865	1,043	514	4	8	4	3	1	3	4	2,961
Oranges	14	18	14	26	29	23	11	6	3	2	13	8	167
Herbs	...	...	...	...	...	...	...	...	...	...	...	12	12
Bamboo Shoots	...	2	...	5	...	...	...	...	...	...	...	...	7
Pomegranates	...	...	...	...	...	...	...	...	...	...	2	...	2
Peanuts	...	...	30	160	...	...	...	...	...	...	...	...	190
Pears—Sand	3	2	8	19	9	10	7	19	12	14	18	16	137
Persimmons	...	...	1	...	...	...	...	...	1	4	1	7	14
Plants	491	422	333	73	129	195	17	31	45	976	331	2,323	5,366
Plums	...	...	...	...	...	...	...	...	...	...	...	4	4
Pomelo	8	2	...	2	...	...	...	...	...	...	2	...	14
Seeds	33	17	32	10	124	6	17	5	575	17	28	31	895

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Sugar Cane	...	...	...	...	...	...	...	...	...	1	...	...	1
Spuds	8	1	2	2	...	2	4	1	1	1	...	1	23
Squash	...	...	...	1	...	...	...	...	...	...	...	...	1
Sweet Potatoes	14	19	10	53	63	16	20	13	...	10	...	23	241
Tangerines	24	11	7	4	4	...	...	...	...	...	19	130	199
Tomatoes	...	...	...	...	...	...	...	...	1	...	...	...	1
Taro	...	4	...	3	...	2	...	...	...	2	1	3	15
Trees	...	...	131	140	...	...	...	...	...	...	...	23	294
Vegetables	...	1	1	3	10	...	...	8	1	...	2	2	28
Lily Bulbs	43	13	2	...	3	...	...	1	6	75	37	120	300
Total	1,100	1,428	2,193	1,649	1,024	394	292	238	719	1,203	602	3,155	13,997

FRUITS AND VEGETABLES RECEIVED AT HILO DURING 1911.

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Apples	408	250	350	310	35	...	40	80	530	620	1,217	1,595	5,435
Apricots	...	...	...	...	...	19	59	20	...	...	...	...	98
Artichokes	1	...	...	...	1	...	1	...	4	1	2	3	13
Beans	215	120	210	75	147	75	115	70	...	...	...	...	1,027
Carrots	...	...	1	1	...	...	...	...	...	...	...	...	2
Cauliflower	1	3	5	3	1	...	2	5	27	5	16	12	80
Celery	1	...	2	2	...	...	...	...	15	8	11	10	49
Cherries	...	...	...	...	60	50	5	...	...	...	...	...	115
Cranberries	...	...	...	...	...	...	...	...	...	...	2	...	2
Grass	...	...	...	...	2	...	...	...	...	...	...	...	2
Garlic	20	20	15	10	12	...	10	10	37	16	10	15	175
Grape Fruit	15	10	15	10	8	5	12	15	29	6	28	18	171
Grapes	...	...	...	...	...	...	15	...	84	48	12	20	179
Lemons	20	12	25	20	25	10	30	25	44	28	36	21	296
Megs	...	...	...	...	...	...	19	5	40	...	...	...	64
Melons	...	...	...	...	...	...	...	...	...	5	14	...	19
Nuts	12	7	6	5	5	4	7	5	12	8	15	12	98
Onions	75	75	85	45	70	40	85	125	272	135	186	206	1,399
Oranges	400	390	475	350	425	195	585	340	491	530	511	736	5,428
Parsnips	...	...	1	...	...	...	...	...	...	...	...	...	1
Peas	...	...	...	...	1	...	...	1	2	...	...	...	5
Peaches	...	...	...	1	...	...	75	...	45	35	...	...	155
Pomegranates	...	...	...	...	...	...	...	...	...	40	50	30	120
Pears	...	...	...	...	...	...	...	10	35	27	23	7	102
Persimmons	...	...	...	...	...	...	...	...	...	...	60	42	102
Plants	1	3	7	10	8	...	...	...	...	4	...	...	33
Plums	...	...	...	...	...	5	36	30	80	25	...	...	176
Pumpkins	...	...	...	...	...	...	...	...	...	...	2	...	2

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Quinces	...	...	...	...	...	...	...	...	...	...	3	...	3
Seeds	8	4	8	12	10	15	10	4	...	6	10	13	100
Sprouts	...	...	...	...	...	...	...	...	...	...	...	1	1
Spuds	325	340	540	210	490	240	525	490	821	545	737	928	6,191
Squash	...	...	...	...	...	...	...	...	...	...	1	...	1
Tangerines	...	100	25	50	10	...	...	...	...	...	32	170	387
Tomatoes	...	...	...	...	...	...	...	...	1	...	...	...	1
Turnips	...	3	6	1	...	...	...	2	2	...	...	2	16
Trees	...	1	...	...	...	...	...	...	...	...	...	...	1
Vegetables	...	2	3	2	3	...	...	3	...	...	...	...	13
Total	1,502	1,340	1,779	1,117	1,313	658	1,631	1,240	2,571	2,092	2,978	3,841	22,062

FRUITS AND VEGETABLES RECEIVED AT HILO DURING 1912.

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Apples	637	620	350	599	225	150	190	240	560	810	980	2,475	7,836
Apricots	...	...	...	...	...	45	40	...	...	...	...	...	85
Artichokes	2	5	...	...	...	2	...	1	...	1	...	4	15
Asparagus	...	...	...	1	5	...	...	...	...	...	...	...	6
Cabbage	...	...	...	6	...	...	...	...	...	...	...	...	6
Cabbage (Pake)	10	...	...	...	...	...	...	...	...	...	...	...	10
Strawberries	...	...	...	...	4	...	...	...	...	...	...	1	5
Carrots	...	...	...	...	4	...	...	...	...	...	...	...	4
Cauliflower	8	10	4	...	10	2	10	4	14	10	15	33	120
Celery	8	7	5	7	...	...	1	...	5	4	...	15	52
Cherries	...	...	...	...	50	14	...	...	...	...	...	...	64
Cranberries	...	...	...	...	...	...	...	...	...	...	1	10	11
Garlic	12	12	4	8	15	8	7	10	10	15	10	35	146
Grape Fruit	10	8	5	8	12	16	13	5	10	14	15	35	151
Grapes	...	...	...	...	...	...	5	20	60	95	144	30	354
Lemons	22	17	10	15	8	65	34	15	23	26	23	75	333
Pomegranates	15	...	...	...	...	...	...	...	...	75	130	60	280
Megs	...	...	...	...	...	1	15	19	15	...	...	...	50
Melons	..	...	...	...	...	...	...	...	...	25	13	3	41
Rhubarb	...	4	2	5	8	3	3	...	...	...	...	3	28
Nuts	15	6	4	7	...	7	5	4	6	...	12	42	108
Onions	125	55	15	25	147	98	145	140	174	206	227	490	1,847
Oranges	630	350	240	642	250	728	710	250	275	275	420	1,967	6,737
Peas	...	...	...	...	4	3	1	...	...	...	...	...	8
Peaches	...	...	...	...	...	44	55	23	32	115	110	...	379
Pears	...	...	...	...	...	...	12	20	16	23	25	84	180
Persimmons	...	...	...	...	...	...	...	...	...	...	140	212	352
Plants	14	10	5	19	5	6	...	...	5	8	10	...	82
Plums	...	...	...	...	...	...	35	25	43	42	15	...	160

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Seeds	6	...	10	9	20	14	12	5	9	10	17	...	112
Sprouts	...	...	...	...	...	...	...	...	...	...	...	3	3
Spuds	725	340	75	315	735	559	357	335	590	615	940	896	6,482
Tangerines	85	156	55	160	...	...	...	...	...	...	...	425	881
Tomatoes	...	6	...	1	...	...	...	...	...	...	...	...	7
Turnips	7	...	...	...	5	2	2	...	...	...	...	...	16
Vegetables	...	...	...	5	...	...	...	...	...	...	...	...	5
Total	2,331	1,606	784	1,832	1,507	1,767	1,652	1,116	1,847	2,369	3,247	6,898	26,956

From the preceding tables it will be seen that there is a lot of important work performed by the inspectors of the Division of Entomology. It is very fortunate that our inspection equipment is so perfect. Having laboratories and fumigating rooms on the three main docks in the harbor has facilitated the work materially and much time and expense is obviated in handling the various shipments. Most important of all is the doing away with the hauling of plant shipments from one dock to another for fumigating purposes, thereby avoiding the great danger of accidentally introducing pests which are liable to be crawling about the packing cases. There is, however, great necessity for a large gas-tight room for the fumigation of large shipments of infested rice, beans, corn and other cereals frequently arriving in the Territory. Unfortunately, the two gas-proof rooms which have been at our disposal on the Channel Dock are now beyond repair as the dock has settled so badly that the walls and floor cannot be made gas-tight any longer and consequently are worthless for our work.

The Japanese Merchants' Association has been co-operating with the importers of rice and beans, as well as with my department, in preventing the shipment of all rice and beans from Kobe, Japan, without first being fumigated and I am pleased to be able to report that during the year 1912 but one infested shipment arrived. During the hot weather from May to September, rice and beans become weevily and despite the fact that shipments are fumigated at the port of debarkation, there is always a possibility of finding some large shipment infested. As all steamers arriving here from Japan must discharge cargo consigned here under Customs rules, the Superintendent is at a loss to prevent the landing of any infested shipment and in the past has found it most expedient to quarantine and fumigate such shipments at the expense of the consignee. Not having any adequate quarters at present for handling large shipments, should any prove to be infested, I should be compelled to detain them until they could be handled in small quantities in the small fumigating room which could hold not more than 80 or 90 bags at a time and this work would seriously interfere with our other duties. The necessity for providing adequate quarters for this work is very apparent and should be seriously considered by the Commissioners.

The following tables give a list of the various pests which were found on fruits, vegetables, plants and in soil and in the packing material surrounding these shipments. Nearly every order of the insect world is represented. Many species have been captured several times. In fact, there is almost a certainty of finding the same species in similar shipments from the same country.

Scale insects are found in numbers on many plants that come into the country and these can fortunately be killed by fumigation, although when plants arrive which are seriously infested with these pests they are destroyed by burning rather than by relying upon the killing off of the pests by fumigation.

Soil attached to the roots of plants I consider of the greatest danger, for in inspection work I have found the grubs of some of the worst enemies of agriculture hidden away among the roots. On several occasions we have taken the grub of the *Anomala* beetle (*Anomala orientalis*) which has been attacking the roots of sugar cane on this island and we have also found in the same soil with this species several larger grubs, representing three other species of the same family of beetles, commonly called White grubs (*Melolonthides*). Quite often caterpillars of various species have been found crawling on the outside of packing cases and specimens of the larvae of the Gypsy Moth (*Porthetria dispar* of Japan) have been taken.

Many shipments contain plants, the foliage of which shows the attack of leafminers, and although we rarely find the larvae, all plants are first fumigated and then every leaf taken off. Whenever any plants are attacked by borers they are immediately burned after the preliminary fumigation.

In nearly all shipments we find various species of Ants which have their nests in the soil or in the packing material. Such shipments require careful handling and all the soil and packing material is first fumigated with Carbon-bisulphide before it is taken to the garbage incinerator for burning.

On several occasions sugar cane has been found in the baggage of tourists. It has also been brought for propagation by returning residents. Knowing of the existence of serious cane diseases in many of the islands of the Pacific, I have always quarantined against such matter and it has been immediately destroyed by burning.

All fruits and vegetables which are found in the baggage of immigrants are taken from them and destroyed. Some of these they obtain on shipboard from the stores and much of it is California fruit, but having found fruit, vegetables, taro, potatoes, onions, ginger and some sugar cane in the same package, as a precautionary measure I have ordered all this material collected and destroyed. There is the greatest danger of introducing some serious cane disease should even this California fruit taken from the ship's stores, be allowed to land after it has been in contact with taro, ginger and sugar cane pickings. Our Immigration Station furnishes the best of food for the newcomers and plenty of fruit is available so that whatever is taken from them by the inspectors is amply replaced.

Injurious Insects and Diseases Intercepted, which were found on Shipments of Fruits, Vegetables and Plants Imported into the Territory during 1911-1912.

Orthoptera (Grasshoppers, Crickets, Cockroaches, etc.)

Eggmasses of *Holoclora species,* Japan	In peach tree twigs.
Tenodera species, A Mantis, Japan	The eggmasses on Azalea.
Ectobia germanica *Periplaneta americana* *Periplancta australasiae*	Three common cockroaches which are often found in packing material and boxes from many countries.
Gryllotalpa species, Singapore	Molecricket. A very serious pest to grazing lands in some countries.
Myrmecophila species, Singapore	A small cricket which is found in ants' nests.
Chelisoches species	A common Earwig often found in packing material and soil from many countries.

Hemiptera Heteroptera (True Bugs).

Capsus species, Manila	A. serious Orchid pest. Taken 14 times.
Tingid species, Manila	Found injuring Orchid leaves.
Murgantia histrionica, U. S. A.	The Harlequin Cabbags bug. A very serious pest on the Mainland.
Aradid species, Manila	Injuring plant stems.

Hemiptera Homoptera (*Aphis, Scale Insects, etc.*).

Aleyrodes citri, Japan	The common citrus White fly.
Aleyrodes spiraeoides, U. S. A.	A common pest on many plants.
Aspidiotus cyanophylli	Scale insects found numerous times on many plants from various countries.
" *cydoniae*	
" *perniciosus*	
" *hederae*	
" *spinosus*	
Asterolecanium bambusae	
Aulacaspis pentagona	
Ceroplastes ceriferus	
" *rusci*	
Chrysomphalus aonidum	
" *biformis*	
Coccus hesperidum	
Diaspis boisduvalii	
Eulecanium magnoliarum	
Hemichionaspis minor	
" *aspidistrae*	
Lepidosaphes euriae	
" *uniloba*	
" *beckii*	
Leucaspis japonica	
Parlatoria proteus	
" *pergandei*	
Phoenicococcus marlatti	
Pinnaspis species	
Pseudaonidia duplex	
Pseudococcus azaleae	
" *pandani*	
" *pini*	
" *longispinus*	
" *virgatus*	
Cerataphis lataniae	On Palms, U. S. A.
Chermes species	On Pinetrees, Japan.
Macrosiphum rosae	On Rose, U. S. A.
" *sanborni*	On Chrysanthemum, U. S. A.
Lachnus species	On Pinetrees, Japan.

Thysanoptera (*Thrips*).

Heliothrips haemorrhoidalis	On Camellia, Sydney.

Coleoptera (*Beetles, Weevils, Borers, etc.*).

Actheopeus aterrimus	Orchids, Manila.
Anomala orientalis	Soil, Japan.
Bostrichus species	Packing case, Manila.
Bruchus pisorum	Beans, Europe.
" *prosopis*	Mesquite pods, Mexico.
" *chinensis*	Peas, Japan.
Belaninus proboscideus	Chestnuts, U. S. A.
" *rectus*	
" *quercus* (larvae)	Acorns, Europe
Carabid beetle	Orchids, Manila.
Calandra granaria	Corn, U. S. A.
" *linearis*	Seeds, Sydney.
" *oryzae*	Rice, Japan.
Clerid species	Wood, Manila.
Cryptorhynchus species	Seeds, Java.
Elater species	Orchids, Manila.
Hister species	Soil, Japan.
Melololontha larvae	Soil, Japan and China.
Scolytid species	Seeds, India.
Staphylinid species	Orchids, Manila.
Cylas formicarius	Sweet potato, Hong Kong.
Tribolium ferrugineum	Rice, Manila.
Tenebrioides mauritanicus	Rice, Japan.

Diptera (*Flies*).

Anthomyid species	Soil, Japan.
Tipulid species	Soil, Japan.
Phorid species	Soil, Japan.
Phorbia brassica	Turnips, U. S. A.
Syrphus species	Orchid, Manila.

Lepidoptera (*Butterflies and Moths*).

Anarsia lineatella	Peaches, U. S. A.
Carpocapsa pomonella	Apples and Pears, U. S. A.
Clisiocampa species, larvae	Fruit trees, Japan.
Cnidocampus flavescens	Fruit trees, Japan.
Lycaenid butterfly	Orchid, Manila.
Noctuid larvae (Cutworm)	Soil, Japan.
Paralipea modesta	Rice, Japan.
Pyralis farinalis	Rice, Japan.
Plodia interpunctella	Beans, Japan.

Lepidoptera (*Continued*).

Porthetria dispar (Gypsy moth)	Plants, Japan.
Parasa species	Mapletrees, Japan.
Pyraustid miner	Rosestems, Japan.
Sesiid larvae	Gardenia, Japan.
Sitotroga cereulella	Corn, U. S. A.
Tineid species	Sisal, Manila.
Tineid leaf miner	Citrus, Japan.
Tortrix leafroller	Plants, Japan.
Thyriodopteryx (three species of Bag Worms)	Plants, Japan.

Hymenoptera (*Bees, Wasps, Ants, etc.*).

Xylocopa brasiliensis	Orchid Logs, Manila.

Ants.

Bothriomyrmex species	Merchandise, Hong Kong.
Cardiocondyla species	Soil, China.
Cremastogaster species	Soil, Japan.
Cremastogaster species	Soil, U. S. A.
“ *sordidula*	Pineapples, Manila.
Dolichoderus bituberculatus	Orchids, Manila.
Diacamma rugosum	Palms, Singapore.
Formica nigra	Plants, California.
Lasius niger	Soil, Japan.
“ *interjectus*	“ “
Monomorium species	Palms, “
“ *minutum*	Soil, Canton.
“ *pharaonis*	Packing Case, Manila.
“ “	“ Japan.
“ “	“ U. S. A.
Ponera species	Soil, Australia.
Prenolepis obscura	“ China.
“ “	“ Java.
Prenolepis bourbonica	“ Japan.
Prenolepis longicornis	“ Manila
“ *melanogaster*	“ “
Pheidole javana	“ Hong Kong.
“ “	“ Manila
Polyrachis dives	Plants, Japan.
Strumigenys lewisi	Orchids, Manila.
Tetramorium species	Teaplant, Japan.
“ *guineense*	Palms, Singapore.

Miscellaneous.

Oniscus species Sowbugs	Soil, Various countries.
Diplopoda Milliped	" " "
Scolopendra Centipede	" " "
Bryobia Red spider	Hydrangea, U. S. A.

Fungi (Blights, Mildews, etc.).

Cladosporium citri	Citrus, Japan.
Fusicladium dendriticum	Apples, U. S. A.
" *pirinum*	Pears, "
Glaeosporium fructigenum	Apples, Japan.
Oospora scabies	Potato, U. S. A.
Phragmidium subcorticatum	Roses, "
Puccinia arenariae	Carnations, "
Sphaerotheca pannosa	Roses, "
Brown velvet *lichen*	Fruit trees, Japan.

INTER ISLAND INSPECTION.

In November, 1910, immediately after the discovery of the *Mediterranean Fruit Fly* on Oahu, the Board of Commissioners of Agriculture and Forestry passed Rule VII, which was duly signed by the Governor on November 21st of the same year. This rule was passed for the purpose of preventing the spread of this pest from Oahu to the other Islands. Unfortunately no provision was made for the appointment of inspectors for this work and the work of the regular horticultural quarantine inspection was so extensive that the two inspectors of that branch of the work found great difficulty in handling this extra inspection. However, through the hearty co-operation of the Inter Island Steam Navigation Company the Division of Entomology was able to prevent any fruit and vegetable freight from being accepted at the wharves and no such freight could leave for the other Islands without being passed by the Inspector or his assist. It was seldom possible to have an inspector present at the departure of inter-island steamers because other steamers from the Mainland or foreign ports demanded our whole attention. It was not until July 1st, 1911, over six months later, that adequate funds, $6000—for a period of fifteen months, were available. The Commissioners then empowered me to employ two inspectors for inter-island inspection. Their work consisted chiefly in keeping tab on all freight shipments and most important of all, in watching the gangways of all Inter-Island boats so as to prevent any person from taking prohibited fruits and vegetables from Oahu to any of the other island ports.

During the period from July 1st, 1911, to December 31st, 1912, there have been 1072 steamers attended to and of the total inspection of fruits, vegetables and plants amounting to 10,966 packages, 1800 packages were refused shipment on account of either being prohibited by law, infested with pests, or having soil attached to the roots which had not been sterilized.

The Superintendent fully realized that the system of inspection which was adopted was not the best but it was the only method which could be used under the existing conditions.

Knowing the danger of carrying the larva and pupa of the *Mediterranean Fruit Fly* in soil attached to plants, it was deemed necessary to replace Rule VII by Rule IX, which rule in addition to fruits, prohibited the shipping of plants and soil but on the other hand permitted all fruits imported into the Territory from the Mainland to be reshipped to the other Islands, if still contained in the original packing case. Again, after working under Rule IX, I experienced a lot of trouble on account of objections to the prohibition of shipment to the other Islands of Taro and Lilyroot, two of the main articles of food of the Hawaiians and Orientals. The claim was made that these products were not infested by the fruit fly, hence there could be no danger in such being shipped to the other islands. On December 18th the Governor signed Rule XI, which had been passed by the Board of Commissioners of Agriculture and Forestry after carefully going over the whole field of prohibited products so that none in which the fruit fly did not breed would be prevented from being shipped either as food or for propagation. in this way avoiding any hardship to consumers. All shipments made came under the direct supervision of the Superintendent of Entomology or his assistant inspector.

The following tables shows the quantity and disposition of the inter-island fruit and plant shipments for a period of eighteen months:

INTER-ISLAND INSPECTION 1911-1912.

Month	Steamer	Plants passed	Fruit passed	Vegetables-passed	Total packages inspected and passed	Plants rejected	Fruits rejected	Vegetables rejected	Total packages rejected	Total packages inspected
July	51	20	3	57	80	10	50	35	95	175
Aug.	59	15	1	86	102	8	80	15	103	205
Sept.	49	10	2	83	95	11	47	12	70	165
Oct.	56	65	4	36	105	12	74	24	110	215
Nov.	45	1,929	3	87	2,019	6	62	5	73	2,092
Dec.	54	58	1	102	161	24	44	16	84	245
Jan.	70	62	2	298	362	6	28	16	50	412
Feb.	60	69	..	159	228	4	24	11	39	267
Mar.	59	76	..	150	226	6	33	17	56	282
Apr.	70	88	1	401	490	1	93	31	125	615
May	64	105	2	447	554	4	189	22	215	769
June	58	45	11	410	466	8	175	21	204	670
July	70	42	4	475	521	8	322	25	355	876
Aug.	60	58	18	473	549	8	42	3	53	602
Sept.	63	75	5	573	653	7	22	1	30	683
Oct.	60	60	14	720	794	22	40	4	66	860
Nov.	62	83	4	798	885	18	24	1	43	928
Dec.	62	66	..	810	876	12	16	1	29	905
Totals	1,072	2,926	75	6,165	9,166	175	1,365	260	1,800	10,966

It is very apparent from the preceding list that in the very near future some decided changes will have to be made to materially broaden the inspection service not only in the inter-island inspection but also in our regular horticultural inspection. Most of the large coastwise steamers now calling at Honolulu carry large freight shipments for ports on the other islands among which is a lot of vegetable matter. This is always inspected at Honolulu and the boats are searched while in port, yet the possibility of the crew landing such material at the other islands is constantly before us. Our honorary inspectors are busy men and cannot be expected to be always present at the landings when steamers are discharging so that there is plenty of opportunity for the landing of fruit, plants and vegetables from vessels. It would be a very easy matter thus to introduce a pest which might become a serious menace to agriculture. To avoid this, especially if direct communication is later on to be established at these ports with the Mainland and foreign ports, it will be absolutely necessary to place qualified and trained inspectors at these ports. Under the present law no fruits or vegetables can be landed at any port in the Islands excepting Honolulu and Hilo but if we do not provide for inspectors at other ports we shall never be able to guard them perfectly under the present system. To inspect products at the port of shipment is very unsatisfactory. In large freight shipments with the co-operation of the various steamship companies it has been done, but it is not in the large freight shipment that the greatest danger lies. It is in the small package which can be easily overlooked, especially if the inspection force is limited as is ours. It is very plain that if the Division of Entomology is to continue the good work of the past and keep out serious pests in the future, now that the general shipping of the Territory has increased and will continue to increase, something to strengthen the work of the Division will have to be done.

There could be no better proof of the benefits of our regular horticultural inspection as well as the benefits of the inter-island inspection than to go over the long list of prohibited and infested fruits and plants, which have been taken during the past two years' service. Where one pest might escape inspection and get introduced, there are hundreds which are kept out of the country through our endeavors, and the more perfect and stronger the inspection force is made the less chances there are of having pests get by us.

Noteworthy is the work performed in 18 months in the inter-island inspection where the system which has been used is of reverse methods from that ordinarily used in inspection work. I refer to outgoing inspection.

Well equipped laboratories and offices for the use of inspectors are absolutely necessary for the welfare of the Agricultural interests of any country, and the whole world is beginning to realize the necessity and importance of Horticultural Inspection. But laboratories and offices alone are insufficient and should be supplemented with a corps of well trained men, who can carry out the duties they are appointed for under the law.

RULE IX.

Rule and Regulation by the Board of Commissioners of Agriculture and Forestry concerning the Prevention of Distribution of Insect Pests from Oahu to the Other Islands.

The Board of Commissioners of Agriculture and Forestry of the Territory of Hawaii hereby make the following rule and regulation:

Section 1. For the purpose of preventing the spread to other Islands in this Territory of insect pests which have established themselves on the Island of Oahu, all persons and corporations are hereby prohibited from carrying or shipping from said Island of Oahu to any other Island in said Territory any fruit, melon, vegetable or root, except fruits, melons, roots or vegetables in original packages imported into this Territory from other places; and all persons and corporations are hereby prohibited from carrying or shipping any plant or any soil attached to any plant or any other soil, from said Island of Oahu to any other Island in this Territory; provided, however, that plants and soils which have been thoroughly fumigated or sterilized under the supervision of the Superintendent of Entomology or his assistants, may be so carried or shipped when properly tagged and certified by any such officer to be free from insect pests.

Section 2. Any person or corporation violating the above rule shall be guilty of a misdemeanor and shall be punished by a fine not to exceed Five Hundred Dollars as provided by Section 390 of the Revised Laws as amended by Act 82 of the Session Laws of 1905 and Act 112 of the Session Laws of 1907.

Section 3. Rule No. 7 of the Board of Commissioners of Agriculture and Forestry adopted and published on the 21st day of November, 1910, is hereby rescinded.

Section 4. This regulation shall take effect upon its approval by the Governor:

Approved:

W. F. FREAR,
Governor of Hawaii.

Honolulu, Territory of Hawaii, June 28, 1911.

RULE XI.

Rule and Regulation by the Board of Commissioners of Agriculture and Forestry Concerning the Prevention of Distribution of Insect Pests from Oahu to the Other Islands.

The Board of Commissioners of Agriculture and Forestry of the Territory of Hawaii hereby make the following rule and regulation:

Section 1. For the purpose of preventing the spread to other Islands in this Territory of insect pests which have established themselves on the Island of Oahu, all persons and corporations are hereby prohibited from carrying or shipping from said Island of Oahu to any other Island in said Territory any fruit, melon, vegetable or root, except fruits, melons, roots or vegetables in original packages imported into this Territory from other places; and all persons and corporations are hereby prohibited from carrying or shipping any plant or any soil attached to any plant or any other soil, from said Island of Oahu to any other Island in this Territory; provided, however, that plants and soils which have been thoroughly fumigated or sterilized under the supervision of the Superintendent of Entomology or his assistants, and taro, lilly,root, tubers and roots which are to be used for food purposes only, upon inspection by the Superintendent of Entomology or his assistants, may be so carried or shipped when properly tagged and certified by any such officer to be free from insect pests.

Section 2. Any person or corporation violating the above rule shall be guilty of a misdemeanor and shall be punished by a fine not to exceed Five Hundred Dollars as provided by Section 390 of the Revised Laws as amended by Act 82 of the Session Laws of 1905 and Act 112 of the Session Laws of 1907.

Section 3. Rule No. 9 of the Board of Commissioners of Agriculture and Forestry adopted and published on the 28th day of June, 1911, is hereby rescinded.

Section 4. This regulation shall take effect upon its approval by the Governor:

Approved:

W. F. FREAR,
Governor of Hawaii.

Honolulu, Territory of Hawaii, December 18, 1911.

FRUIT FLY CONTROL.

From the very first appearance of the Mediterranean Fruit Fly (*Ceratitis capitata*) on the Island of Oahu, my department became directly interested in the work of checking its spread as far as this was possible with the limited appropriation at our command. The Board of Commissioners were, however, unable to employ inspectors or field agents to prevent infested fruits from being carried from one place to another, nor had they means even to engage extra inspectors to watch the shipments going to the other islands. Through the hearty co-operation of the Inter-Island Steam Navigation Company I was able to prevent any freight shipments of fruit and vegetables from being taken to any of the other islands as they were very willing to abide by the existing Rule and Regulation (Rule VII), which prohibited the carrying or shipping of Oranges, Lemons, Limes, Mangoes, Alligator Pears, Guavas, Peaches, or other soft meated fruits. This rule was signed by the Governor on November 21st, 1910, very shortly after the Fruit fly made its appearance.

It was on October 6, 1910, that the Board of Commissioners of Agriculture and Forestry requested me to notify the California Horticultural Commission of the appearance of the fly on Oahu. A strong appeal was made to the public through the press and through various other channels, to have all fallen fruit gathered up and destroyed and in this way to adopt the only feasible check by which this terrible pest could be reduced. It was gratifying to see that many individuals became interested and followed the advice given. Many others, however, were indifferent or neglectful in the matter and it became quite apparent that to do really good work it would be necessary to appoint inspectors with power to enforce a general cleanup of all fallen and infested fruit, as well as to place some capable men on the docks of Inter-Island boats so as to prevent the traveling public from carrying any prohibited fruits from Oahu to any of the other Islands. Up to this time no report of the appearance of the fly on the other Islands had been made, although a close watch had been kept, and many fruit samples had been received from those interested in the matter.

It was not until July 1st, 1911, however, six months after Rule VII was passed, that adequate funds were available for inter-island inspection but no provision was made for a local cleanup campaign until later on. On this date the Board of Commissioners placed two inspectors at my disposal principally for watching Inter-Island shipments and more particularly the gangways of all steamers, in an endeavor to prevent any fruit from being taken by passengers in their baggage or otherwise. This was the best and only step that could be taken under existing conditions and then the word of a passenger had to be taken, when asked about his baggage.

I fully realized that to efficiently inspect fruit shipments and baggage, the work should be done at the port of destination, the logical place to do inspection work, not at the port of embarkation. The shortage of funds and the scarcity of trained inspectors made such a system impossible. It also did not provide for the establishment of an up-to-date clean-culture campaign against the fly on Oahu.

About the middle of September, 1911, over a year after the Board of Commissioners had notified the California Horticultural Commission of the outbreak, the State of California took a firm stand regarding fruit shipments from the Hawaiian Islands and requested the Board of Commissioners of Agriculture and Forestry to undertake a thorough campaign against the fruit fly. All fruits, excepting Pineapples and Bananas, were prohibited from being shipped from the Islands to the Coast, and the California Horticultural Commission gave the assurance that Pineapples and Bananas would continue as shipments if the work of a thorough clean-up was carried on satisfactorily. In consequence of this the Board of Commissioners secured sufficient funds and on November 1, 1911, established a department for Fruit Fly Control and appointed Mr. Walter M. Giffard as Director.

Although this department was entirely separate from the Division of Entomology, it was more or less in close co-operation with it throughout its entire existence. Having well equipped laboratories it was deemed best to turn all work that required scientific investigations over to the writer. Miss Louise Gulick, a student in Biology, and later Miss Maude Dawson, were employed as laboratory assistants and during the period of the Fruit Fly Control work the various species of infested fruits which were collected by the inspectors under Mr. Giffard, throughout the controlled district, as well as many samples sent in by interested citizens, were turned over to us. These were carefully labelled, recorded, tabulated, placed in breeding jars, and a thorough daily record kept of all insects which were reared from the fruits. About 240 samples of fruits have been handled by the Division of Entomology and our records show that the following fruits, berries and seeds have been attacked by the Mediterranean fruit fly:

List of Fruits and Vegetables Attacked.

Strawberry Guava
Alligator Pear
Guava (garden varieties)
Orange (varieties of sweet and sour)
Chinese Plum (*Noronhia emarginata*)
Papaya (in ripe condition)
Cestrum (Chinese Ink Berry)
Kamani Seeds (species)
Prickly Pear (*Opuntia tuna*)
Loquat (*Eriabotrya japonica*)
Var. Persimmon (1 introduced tree)
Kumquat (*Citrus japonica*)
Eugenia (species)
Murraya exotica (small red fruit locally known as Mock Orange)
Chrysophyllum oliviforme (called Damson plum in Jamaica)
Peach
Chinese Orange
Green Peppers
Squash
Figs
Rose Apple
Star Apple
Mountain Apple
Coffee Berries
Wild Guava
Mango
Grape Fruit
Carissa arduina (Natal plum)
Limes (varieties)
Carambola.

Seeing the great importance of keeping the fruit fly out of California, the Horticultural Commission of that State was able to contribute by arrangement with the Director, its share towards the clean-up campaign, and also sent a representative, Mr. H. A. Weinland, who arrived on December 26th, 1911. His hearty co-operation with both the Director of the Fruit Fly Control and the Superintendent of the Division of Entomology was always most cordial and pleasant. Under the direction and in co-operation with Mr. Giffard, Mr. Weinland gave his personal supervision to a number of experiments in trapping the adult flies. This work had been carried on previous to Mr. Weinland's arrival, but owing to our limited force and time, the daily trap examinations could not always be kept up. We gladly turned our small equipment over to Mr. Weinland and he soon improved and enlarged the same. His records are on file in the laboratory. Later in the season very extensive spraying experiments were undertaken in the same manner throughout the control district and some even in the wild guava on the mountain slopes. The results of all this have been submitted to the Director of the Fruit Fly Control and are on file in his office.

During much of the time of the campaign against the fruit fly uncertain reports had existed regarding the possibility of the wild guava having some bearing as a drawback to the clean culture campaign in controlling the pest, some claiming that enormous infestations could always be found, while others opposed this view. It was deemed advisable to carry on a breeding experiment so as to be able to determine just what percent of guavas were infested. This work was undertaken by Mr. Weinland, who carefully collected 9 average lots of guavas consisting of 12 fruits per lot. The fruit was gathered in the various valleys surrounding the control area. This fruit was placed in breeding jars and a thorough record kept of all flies that issued. It resulted in finding that the lowest yield was 1 fly from 12 guavas and the highest yield was 40 flies from 12 guavas. The total average being less than 1½ flies from one fruit. I have personally examined many lots of guavas collected from various sections and the low infestation by maggots was very noticeable. In one instance out of two 5-gallon can lots of guavas from Manoa Valley, not a maggot-infested fruit was found, every fruit having been carefully opened. This fruit was gathered during the season when other fruits were scarce. The appearance of the fly on the other Islands has been reported to the Commissioners as soon as positive proof was at hand. Many samples of fruit had been sent during the campaign and many species of flies, among them the commonly distributed Melon fly, were reared, but official reports of the occurrence of the Mediterranean fly on the other islands was only made when we, ourselves, reared the fly from fruit samples received. The fly is now found on all the larger Islands except Lanai. On the Island of Maui it is found in limited numbers in two sections. On Hawaii the fly has not been reported from the Hilo, Puna and Kau districts. Everything possible has been done by the Board of Commissioners, County officers and other officials appointed or co-operating with it, to keep the pest out of these districts as shown by the reports on file in the Board's office. The thorough and businesslike manner in which the campaign was conducted has been favorably commented upon by many and will stand as one of the most important works ever undertaken by the Board of Agriculture and Forestry. A complete report of this work can be found in the "Hawaiian Forester and Agriculturist." Suffice it to say that conditions as existing today in comparison with the conditions which existed before the Fruit fly campaign started are beyond expectation. At times one would believe that the Fruit fly did not exist on the Islands, such improvement can be found in the control area.

Again, owing to the changed conditions of the appearance and prevalence of Fruit fly on the other Islands, it was found necessary to slightly modify the Territorial regulations so as to overcome the difficulty of transporting certain fruits and vegetables from one infested district to another, which the old regulations in a measure prevented. A desire was felt that it would be best to simplify matters materially by combining all the rules and regulations pertaining to Fruit fly control under one head and after due consideration Rule XVII was drawn up by the Attorney-General to take the place of Rules X. XI, XIV, XV and XVI, which under present conditions will better answer the purpose of the Board. After it was duly passed by the Board of Commissioners it was signed by the Governor on September 17th, 1912.

The Agricultural Bill as passed by Congress provides the sum of $35,000 for the Investigation of the Mediterranean Fruit Fly in the United States and its Territories. As soon as this money became available, Dr. E. A. Back of the Bureau of Entomology of the U. S. Department of Agriculture was delegated to take charge of the work in Hawaii. He arrived in Honolulu on August 29, 1912, accompanied by Dr. C. L. Marlatt, Assistant Chief of the Federal Bureau of Entomology. The director of the Fruit Fly Control and these gentlemen arranged matters in a very satisfactory way regarding the continuance of the campaign on lines similar to those started by the Director of Fruit Fly Control. On September 15th, Dr. Back took full charge of the work so ably conducted until that time under the direction of Mr. Giffard. The latter has turned over to the Federal Department the use of all the records and available materials on hand and the work is now being carried on under the able superintendence of Dr. Back.

RULE XVII.

Rule and Regulation of the Board of Commissioners of Agriculture and Forestry Concerning the Control of the Mediterranean Fruit-Fly and Other Insect and Vegetable Pests, Repealing Rules X, XI, XIV, XV and XVI of the Board of Agriculture and Forestry.

The Board of Commissioners of Agriculture and Forestry, of the Territory of Hawaii, hereby make the following rules and regulations for the purpose of controlling and diminishing or eradicating the Mediterranean fruit-fly and other injurious fruit-flies and the larvae thereof and preventing or diminishing the damage and loss causable by them.

Section 1. All fruit, ripe or unripe, whether on the ground or on the tree, or elsewhere on any premises, and all melons and vegetables on any premises, which appear to be infested by the Mediterranean fruit-fly or any other injurious fruit-fly or the larvae thereof, shall daily be collected by the occupant, or, if no occupant, by the controller of the property on which such fruit, melon or vegetable exists, and thoroughly destroyed by burning or by such other effective means as the duly appointed agents of the Board of Agriculture and Forestry may deem sufficient, or so treated as effectually to destroy any larvae therein of any such fly, or, if within any garbage collection limits, placed in suitable containers, which shall be set conveniently for the garbage collectors.

Section 2. No fruit, ripe or unripe, which has fallen from the tree, shall be allowed to remain on the ground on any premises, but such fruit shall be daily collected by the owner, occupant, or controller of such premises and thoroughly destroyed or disposed of in the manner prescribed by Section 1 of these Rules and Regulations.

Section 3. No fruit, melon or vegetable infested by the Mediterranean or other fruit-fly or the larvae thereof, shall be sold or offered for sale, and any such fruit, melon or vegetables exposed or offered for sale, may be seized by any inspector or other duly appointed agent of the Board of Agriculture and Forestry.

Section 4. No fruit, melon or vegetable shall be thrown, discarded or placed on any sidewalk, road, thoroughfare, dump, roadgutter, river-bed, gulch, sea-beach, vacant lot or park.

Section 5. All persons and corporations are hereby prohibited from carrying, transporting or shipping from any Island in this Territory to any other Island in this Territory any infected fruit, melon, vegetable or root; and persons and corporations are hereby prohibited from carrying or shipping any sugar-cane, plant or any soil attached to any plant, or any other soil from any Island in this Territory to any other Island in this Territory; (provided, however, that sugar-cane, plants and soils which have been thoroughly fumigated or sterilized under the supervision of the Superintendent of Entomology or his assistants, and taro, lily root, tubers and roots which are to be used for food purposes only, upon inspection by the Superintendent of Entomology or his assistants, may be so carried or shipped when properly tagged and certified by any such officer to be free from insect pests).

Section 6. Inspectors and other duly appointed agents of the Board of Agriculture and Forestry are hereby empowered to remove or cause to be removed from fruit trees, shrubs, and plants any and

all fruit or vegetables which are infested with the Mediterranean or other fruit-fly or the larvae thereof, and to have the same destroyed, treated or disposed of in the manner prescribed in Section 1 hereof.

Section 7. No fruit, melon or vegetables carried or shipped from any port in this Territory to any other port in this Territory shall be allowed to land, except pineapples, bananas, alligator pears, cabbage, onion, potatoes and other root crops and such other fruits and vegetables including imported fruits and vegetables which have been inspected and certified to as being free from Mediterranean fruit-fly infestations by the Superintendent of Entomology or his authorized assistants. Inspectors and other duly appointed agents of the Board of Agriculture and Forestry are hereby empowered to examine and inspect all freight, baggage and belongings landed at any such ports, and to destroy, treat or dispose of any and all such prohibited fruit, melon or vegetables found among such freight, baggage or belongings.

Section 8. Any person violating the above rule shall be guilty of misdemeanor, and upon conviction thereof shall be punished by a fine not to exceed Five Hundred ($500) Dollars, as provided by Section 390 of the Revised Laws as amended by Act 82 of the Session Laws of 1905, and Act 112 of the Session Laws of 1907.

Section 9. Rules X, XI, XIV, XV and XVI of the Board of Agriculture and Forestry are hereby repealed.

Section 10. This Rule shall take effect upon its approval by the Governor.

Approved:

W. F. FREAR,
Governor of Hawaii.

Honolulu, Territory of Hawaii, September 17, 1912.

GENERAL CLEAN-CULTURE.

Under Quarantine Order No. 6 of the California Commission of Horticulture, only Pineapples and Bananas are permitted to be shipped from the Hawaiian Islands to the Coast. Since the outbreak of the Mediterranean Fruit fly a closer inspection of these fruits had revealed the fact that many shipments were badly infested with scale insects, more particularly mealy bugs. Under instructions from the Commissioner of Horticulture the Quarantine officer at San Francisco notified this Board of the seriousness of this matter and requested that clean shipments only be made and notified the Board that unless conditions improved all fruit shipments, especially Banana shipments, would have to be discontinued. Another objection was raised against the material used as wrappers for Bananas. It has been the custom to use old, dried banana leaves and Hilo grass as such. The greatest objection was against the use of Hilo grass on account of the possibility of introducing the pupa of the Mediterranean Fruit fly. As most of this grass is collected in the regions of wild guava their objection to this sort of packing no doubt was well taken. The objection to the use of banana leaves was on account of finding these badly infested with at least two scale insects. The whole matter was thoroughly discussed and looked into with the result that the growers agreed to comply with the demands made by the California Horticultural Commission and rice straw has been largely used as wrapping material for all Banana shipments.

The California Inspector had insisted on fumigating all infested Pineapples and Bananas on arrival at San Francisco with the result that much loss to the fruit was experienced. One of the Banana shippers here thought that the damage to the fruit was caused by the manner in which the fumigation was done and requested me to make a test here. He furnished 6 bunches of bananas in a very sound and unripe condition and I made a thorough test with the fumigation. I held the fruit in a cool, dry place for 6 or 8 days after it had been fumigated so as to allow it to ripen and the result was as expected, all the fumigated bunches turned black as they did on the Coast. The non-fumigated bunch which was held as a check turned a beautiful yellow. The barring out of infested bananas created quite a stir here among the shippers and I was requested to visit some plantations to see what could be done to overcome the trouble. Some of the places visited were found to be in a most deplorable condition. Many of the older plantations had been permitted to become very badly infested with two serious scale insects (*Hemichionaspis minor*) and (*Chysomphalus aonidum*) as well as with a mealy bug (*Pseudococcus bromeliae*). The general appearance of the plants showed wanton neglect. Old, worthless banana plants were mixed with badly infested young growth. The old, dried leaves showing severe attacks of scale insects, were hanging from every plant. Here and there a sunshade made of old, infested leaves, was covering a large bunch of bananas and with the aid of a lens the young scale insects could be seen crawling from the drying leaf to the green bunch. The stumps which had produced bunches were permitted to remain standing among the new growth and under the leaf stems of these were thousands of mealy bugs, the young of which were carried by armies of ants (*Pheidole megacephala*) to the adjoining growth. To overcome these conditions meant more than mere advice from the Board of Agriculture and Forestry, for advice was not always taken. The Chinese grower, especially, is so imbued with the old way of cultivating bananas that it is next to impossible to convince him that there is a cleaner and better way.

The situation which presented itself was a difficult one and as Dr. E. V. Wilcox of the Hawaii Agricultural Experiment Station, U. S. Department of Agriculture, had studied banana growing, I thought it wise to call him in as advisor and to assist in persuading the Chinese grower out of the belief that cutting the old stumps would shorten the life of his plantation and make his fruit inferior. Dr. Wilcox willingly co-operated with my department and we were soon able to induce a grower or two to try our method. Yet this in itself would not cure the situation, for there were a number of growers who had made contracts for their crops who would do nothing and the only businesslike way to force the matter was to pass a Rule and Regulation compelling a thorough clean up, not only of banana fields but of any and all fields, groves and premises. Upon my recommendation the Board of Commissioners of Agriculture and Forestry passed Rule XII, which gives the Commissioners, or their representatives, power to enter into and inspect any premise, property or field with trees, plants or crops and inspect the same and if conditions warrant it to recommend such remedies as will tend to eradicate any pest found thereon. The Governor duly signed this rule on December 30th, 1911.

The passage of this rule had its effect. The Board of Commissioners appointed Mr. S. T. Starrett, the Superintendent of the Marketing Division, an honorary inspector under me to enforce a clean up of banana fields whenever he deemed it necessary and to reject all bananas, all of which came under his control, found infested with scale insects. The growers soon appreciated the situation. Many old fiields were uprooted and replanted to new, healthy plants, others were cleaned up of all worthless stumps, dried leaves and rubbish. After such thorough work we find today a vast improvement in all the plantations, and we have not only clean fruit, but the quality and size of the bunches has greatly improved.

COTTON BOLL WORM.

The serious damage done by the Pink Cotton Boll Worm (*Gelechia gossypiella*) has been commented on in previous reports. Many experiments have been conducted by the Federal Station in trying to check the ravages and the great loss caused by this pest. One experiment in particular, that of pruning the plants after the last picking is done, so as to remove all late bolls, has proven quite a success for it reduces the breeding places of the cotton pest.

By the aid of Rule XII we have been able to help eradicate some 12 acres of neglected fields adjacent to some where the best cultural methods were employed. Mr. Joseph Clark, a cotton grower, called my attention to these conditions and he volunteered to act as an honorary inspector for his district. The Commissioners appointed him as such under me and he was able to do some very effective work. The infested fields had been planted by some Japanese, who finding them unprofitable, let them grow up to weeds. Nevertheless the plants continued to produce abundant small bolls in which the Boll worm found favorable breeding ground. From this infested area the pest was constantly making inroads into the cultivated fields and caused serious losses to the owners. Once the fields were uprooted and the breeding ground destroyed, there was a great improvement in the percentage of uninfested bolls.

The Pineapple growers took care of their own interests and not many complaints have been made regarding pineapple shipments. These are still fumigated at Coast points. It would be a very good plan to have someone act as field inspector for this industry. The old, neglected, pest-infested fields should be taken care of. Old infested plants should not be allowed to be piled up along the roadside adjacent to newly planted fields. The cleaning up of all infested areas in a systematic way would mean much toward clean shipments of fruit to the Coast.

RULE XII.

Rule and Regulation of the Board of Commissioners of Agricluture and Forestry Concerning the Control of Insect and Other Vegetable Pests in the Territory of Hawaii.

The Board of Commissioners of Agriculture and Forestry of the Territory of Hawaii hereby make the following rules and regulations for the purpose of controlling and diminishing or eradicating injurious insects, blights, scales and pests, injurious or liable to become injurious, to trees, plants, or other vegetation of value and the fruit thereof.

Section 1. In view of the presence of injurious insects, blights, scales and pests which are a detriment or which may become a detriment to the agricultural industries of the Territory and for the purpose of preventing or diminishing the damage and loss causable by them, all inspectors and other duly appointed agents of the Board of Agriculture and Forestry are hereby empowered to enter at all reasonable times any and all farms, orchards and premises in said Territory, where there are agricultural growths and products, for the purpose of inspecting trees, plants, cuttings, vines, fruits, vegetables, tubers, roots, seeds and other agricultural growths and products thereon.

Section 2. Whenever such injurious insects, blights, scales, or pests are discovered on any premises, inspectors and duly appointed agents of the Board of Agriculture and Forestry shall advise the growers of the crops on such premises as to the best methods of reducing the damage that may be caused thereby, and all fruits, plants, cuttings, vines, vegetables, tubers, roots, seeds or leaves infected with any such insect, blight, scale or pest, shall be destroyed at once by the grower thereof by methods prescribed by the Superintendent of Entomology upon the request of any such inspector or agent.

Section 3. All inspectors and other duly appointed agents of the Board of Agriculture and Forestry are hereby empowered to seize and destroy any fruit, plant, cutting, vines, vegetables, tubers, roots,

seeds, or leaves infected with any such insects, blights, scales or pests found in any shipment in any part of the Territory.

Section 4. Any person, firm or corporation violating the above rule shall be guilty of a misdemeanor and upon conviction thereof shall be punished by a fine not to exceed Five Hundred Dollars, as provided by section 390 of the Revised Laws, as amended by Act 82 of the Session Laws of 1905, and Act 112 of the Session Laws of 1907.

Section 5. This rule shall take effect upon its approval by the Governor.

Approved:

W. F. FREAR,
Governor of Hawaii.

Honolulu, Territory of Hawaii, December 30, 1911.

BANANA DISEASE.

The Banana industry of the Territory is a profitable one and, generally speaking, Banana culture is not hampered with any serious disease or pest when up to date cultural methods are used. Owing to an outbreak of a serious disease of the banana in Central America, the West Indies and adjacent countries, and in view of the fact that there was a possibility of bringing into the Territory banana plants from these sections, the Board of Commissioners of Agriculture and Forestry passed Rule VIII, which prohibited the introduction of any Banana fruit, Banana sprouts or plants from Central America, including the Panama Canal Zone, the West Indies, Dutch Guiana, or any other locality where the said disease exists or may become known to exist. The importance of this Rule is very apparent now that direct communication is to be had with the above named countries. Under this rule, during the years 1911 and 1912, we have had occasion to destroy a few banana plants arriving in some plant shipments.

RULE VIII.

Rule and Regulation by the Board of Commissioners of Agriculture and Forestry Concerning the Importation of All Banana Fruit, Banana Shoots or Plants.

Whereas, This Board has, by notification of the United States Department of Agriculture and by its own investigation, been apprised of the existence of a serious and infectious plant disease on banana in many parts of the world, which disease is rapidly spreading throughout the infested localities, necessitating the abandonment of thousands of acres of banana plantations therein, and is extending to other localities, and inasmuch as the existence of this disease in imported plants and fruit can not be ascertained by local inspection nor eradicated by fumigation, and no good method of control of the disease has yet been found,

Therefore, The Board of Commissioners of Agriculture and Forestry of the Territory of Hawaii hereby make the following rule and regulation:

Section 1. For the purpose of preventing the introduction into the Territory of Hawaii of a banana disease known also as banana blight, and determined as *Fusarium cubense*, all persons, companies and corporations are hereby prohibited from introducing or importing into the Territory of Hawaii, or into any of its ports for the purpose of debarkation into said Territory any fresh banana fruit, banana sprouts or plants, from Central America, including the Panama Canal Zone, the West Indies, Dutch Guiana or any other locality where the said disease exists or may become known to exist.

Section 2. This regulation shall take effect from and after the approval thereof by the Governor.

MARSTON CAMPBELL,
President and Executive Officer, Board of Commissioners of Agriculture and Forestry.

Approved:

W. F. FREAR,
Governor of Hawaii.

Honolulu, Territory of Hawaii, January 25, 1911.

SEED INSPECTION.

The last Legislature passed an Act (Act 107, Session Laws of 1911) to regulate the importation and sale of seed into and within the Territory of Hawaii, but did not provide funds for the appointment of a Territorial Seed Inspector. The Division of Entomology has in the past inspected all imported seed to prevent the introduction of seed pests. Under this Act, known as the Pure Seed Law, I have been looking into the quality of all seed shipments.

During the biennial period my Division has taken samples of all shipments, consisting mainly of forage seeds, and in every instance the seed was found very free from adulterations as far as the examination with lenses could go. Not having the necessary equipment for a thorough test by sprouting, no experiments were conducted on these lines.

PURE SEED LAW. ACT 107, SESSION LAWS OF 1911.

AN ACT

To Regulate the Importation and Sale of Seed Into and Within the Territory of Hawaii.

Be it Enacted by the Legislature of the Territory of Hawaii:

Section 1. That the importation for seeding purposes into the Territory of Hawaii of seeds of alfalfa, barley, Canadian blue grass, Kentucky blue grass, brome grass (awnless), buckwheat, alsike clover, crimson clover, red clover, white clover, field corn, Kafir corn, meadow fescue, flax, millet, oats, orchard grass, rape, red top,

rye, sorghum, timothy, vetch and wheat which are adulterated or unfit for seeding purposes within the meaning of this act is hereby prohibited, and the Board of Commissioners of Agriculture and Forestry is hereby authorized and empowered to make such rules and regulations, subject to the approval of the Governor of the Territory, as will provide for the exclusion of such seeds from the Territory of Hawaii.

Section 2. That seed shall be considered adulterated within the meaning of this Act: First, when seed of red clover contains more than three per centum of seed of yellow trefoil or any other seed of similar appearance to and of lower market value than seed of red clover; second, when seed of alfalfa contains more than three per centum of seed of yellow trefoil, burr clover, or sweet clover, singly or combined; third, when any kind or variety of the seeds named in Section 1 of this Act contains over five per centum of seed of another kind or variety of lower market value and of similar appearance. Provided, that the provisions of this paragraph shall not apply to mixtures of white and alsike clover, red and alsike clover, alsike clover and timothy.

Section 3. That seed shall be considered unfit for seeding purposes within the meaning of this Act: First, when any kind or variety of clover or alfalfa seed contains more than one seed of dodder to five grams of clover or alfalfa; second, when any kind or variety of the seeds named in Section 1 of this Act contains more than three per centum, by weight, of seeds of weeds.

Section 4. That each and every package or lot of agricultural seeds of the kinds named in section 1, containing one pound or more, whether in package or bulk, which is sold, offered or exposed for sale by any person, firm or corporation in the Territory of Hawaii shall be plainly, legibly and indelibly labeled in English upon the exterior of the container, with a written or printed label. Such label shal show:

First: The commonly accepted name of the kind and variety of seed;

Second: The full name and address of the person, firm or corporation selling, offering or exposing the seed for sale.

Section 5. That in case of sale, offering or exposure for sale of mixed seeds, the package or containers shall be plainly labeled upon the exterior of the container with correct common name of the kinds or varieties of seed composing the mixture.

Section 6. That no person, firm or corporation shall sell, offer or expose for sale in the Territory any agricultural or garden seeds, excepting only garden seeds in a packet or a package of one pound or less, which contain in greater number than one to two thousand of the seeds under examination the seeds of the following named noxious weeds:

Canada thistle (*Carduus arvensis*), Russian thistle (*Salsola tragus*), couch, quack or quitch grass (*Agropyron repens*), clover dodder (*Cuscuta epithymum*), field dodder (*Cuscuta arvensis*), sow thistle (*Sonchus arvensis*); and the sale of agricultural or garden seeds containing more than a reasonable trace of the seeds of wild oats (*Avena fauta*), burr-grass (*Cenchrus tribuloides*), witch grass (*Panicum capillare*), porcupine grass (*Stipa spartea*), knot-grass (*Polygonum aviculare*), sorrel (*Rumex Acetosa*), Mexican tea (*Chenopodium* *ambrosioides*), charlock (*Brassica arvensis*), hedge mustard (*Sysimbrium officinale*), black mustard (*Brassica nigra*), Shepherd's purse (*Capsella Bursapastoris*), wild pepper-grass (*Lepidium Virginicum*), Jimson weeds (*Datura Stramonium & D. Tatula*), rib-grass (*Plantago lanceolata*), ragweed (*Ambrosia artemisiifolia*), may-weed (*Anthemis Cotula*), burdock (*Arctium Lappa*), ox-eye daisy (*Chrysanthemum Leucanthemum*), chicory (*Chichorium Intybus*), bull-thistle (*Carduus lanceolatus*), black-eyed Susan (*Rudbeckia hirta*), broad cocklebur (*Xanthium strumarium*), or the seeds of any other plants which may, from time to time, be specified in rules and regulations to be issued by the Board of Commissioners of Agriculture and Forestry as noxious weeds, is unlawful.

Section 7. That it shall be unlawful for any person, either for himself or while acting as agent or servant of any other person, firm or corporation, to sell, offer or expose for sale, or to deliver within the Territory of Hawaii any seeds that are misbranded within the meaning of this Act. Seed or seeds shall be deemed to be misbranded if the contents of any sack or lot of seeds, whether in package or in bulk containers, is not labeled in accordance with the requirements of Sections 4, 5 and 9 of this Act, or if such seed or seeds is falsely labeled in any respect.

Section 8. Whoever sells, offers or exposes for sale in the Territory of Hawaii any seeds without complying with the requirements of Sections 5 and 5 of this Act, or in violation of Sections 6 and 9 of this Act, shall be deemed guilty of a misdemeanor, and on conviction shall be fined not less than Ten Dollars ($10.00) and the costs, nor more than One Hundred ($100.00) and the costs of the prosecution for the first offense, and not less than One Hundred Dollars ($100.00) and costs, nor more than Five Hundred Dollars ($500.00) and costs of prosecution for the second and subsequent offenses.

Section 9. The provisions of this Act shall not apply to any person, firm or corporation, growing or selling or exposing for sale cereals or other seeds for manufacturing purposes, for food or forage. Provided, that the provisions of this Act shall not apply to the sale or exposure for sale of uncleaned seed, provided each package, lot or bulk of such uncleaned seed sold, exposed or offered for sale be plainly labeled with the words "Uncleaned Seed," and provided, further, that in case of large quantities of such unclean seeds stored in an elevator granary or warehouse, they shall be labeled, the bins or subdivisions, "Uncleaned Seeds," and no such uncleaned seeds shall be sold or delivered within the Territory, for sowing purposes without the consent of the purchaser. This Act shall not apply to seeds or grains in transit.

Section 10. The Board of Commissioners of Agriculture and Forestry may inspect, examine and make analysis of, or test seed sold, offered or exposed for sale in the Territory at such times and places and to such extent as it may determine. The said Board is hereby authorized and empowered to appoint a Territorial seed inspector and such other agents as it may deem necessary to carry out the provisions of this Act, and said inspector or agents shall have free access at all reasonable hours upon and into any premises or structures to make examinations of any seeds, whether such seeds are upon the premises of the owner of such seeds or on other premises; and may take from any person, firm or corporation any sample or samples of such seeds.

Section 11. This act shall take effect from and after the date of its approval.

Approved this 20th day of April, A. D. 1911.

WALTER F. FREAR,
Governor of the Territory of Hawaii.

HORN FLY PARASITE.

During 1911 and 1912 Mr. Albert Koebele has continued his researches in Europe for enemies of the Hornfly (*Haematobia serrata*) and all the material he collected and sent to Hawaii has been turned over to the Entomologist of. the Hawaiian Sugar Planters' Experiment Station for breeding and distribution as has been done in previous years. A considerable number of vials, containing various parasitized pupae of the Hornfly and species closely related to it have been received, some in a very poor condition while others have yielded a number of promising parasites which have been liberated in favorable localities. Following are the reports submitted by Mr. O. H. Swezey, Entomologist of the H. S. P. A., for the years 1911 and 1912, he having had charge of most of the breeding experiments:

RECORD OF THE HORNFLY PARASITE MATERIAL RECEIVED FROM MR. A. KOEBELE IN EUROPE, DURING 1911.

During 1911 Mr. Koebele continued investigations of *Hymenopterous* parasites of hornfly and related flies in Europe. The material received from him came mostly during the last three months of the year, previous experience having demonstrated the futility of sending material during the hot summer months. In all, 25 vials of dipterous puparia were received. These were supposed to contain some that were parasitized, and from which the parasites would emerge on arrival. Mr. Koebele had given his attention mostly to *Figites*, a *cynipid*, which he found abundantly parasitizing the maggots of *Haematobia stimulans*, a close relative of the Hornfly.

Only a few parasites emerged at any one time from the material received from Mr. Koebele. At first attempts were made to breed them in confinement but all failed. After we heard from Mr. Koebele that he, too, had not been able to breed them in confinement, most of the others that emerged were liberated in a dairy pasture after the sexes had been kept together long enough for mating. These liberations were only in small numbers at a time and there was very small chance of the parasites becoming established. None are known to have succeeded.

Following is an enumeration of the different shipments received with date of receipt, number and kind of parasites that emerged, disposition, etc.:

No. 276, March 4th
Nos. 277-280, March 15th   Puparia of *Polietes lardaria.*

We failed to receive any letter with this lot and did not know till afterwards that Mr. Koebele desired the flies that emerged from these to be liberated, as their larva are of predaceous habit, eating large numbers of other maggots. Not knowing this in time, all flies that emerged were promptly killed, as we have always done with his material, extreme care being taken to avoid any of the hosts becoming introduced while attempting to introduce parasites. After the emergence of the flies, about four dozen puparia remained that were apparently parasitized. No parasites emerged, however, until October. Two female *Cynipids* emerged October 19th. No more emerged and no males, hence they were of no avail. This is a very long period to remain dormant, and a parasite having that habit would accomplish very little even if it became established in Hawaii.

No. 281, June 14th.

All flies had emerged and died before arrival, except from one puparium which contained pupa of *Figites.*

Nos. 282-283, September 26th. Puparia of *Haematobia stimulans.*

Twelve female and nine male *Figites* emerged from this material, one or two at a time, during the following month. Attempts were made to breed them on Hornfly maggots but all failed, though given the best chance possible with such small numbers.

No. 284, October 18th. Same kind of material as preceding.

Nine female and seventeen male *Figites* emerged during the following four weeks. Those emerging the first two weeks were given a chance to breed in confinement; the later ones were liberated in a dairy.

No. 285, October 18th. Puparia of *Hylemia.*

No parasites emerged.

No. 286. Same as 285 but failed to arrive.

Nos. 287-288, October 30th. Puparia of *Haematobia stimulans.*

Eleven female and five male *Figites* emerged during the following three weeks. Were liberated.

No. 289, November 9th. Puparia of *Hylemia* supposed to be parasitized by Atractodes and Alysia. No parasites emerged.

Nos. 290-291, November 9th. Puparia of *Haematobia stimulans.*

Twelve female and fifteen male *Figites* emerged during the following two weeks. They were liberated. One female *Bathy-*

metis emerged November 14th and another November 22nd. There were three dead adult *Bathymetis* when the material arrived.

No. 292, November 9th. This was a shipment of ladybirds, *Coccinella bipunctata.*

About 200 were alive on arrival. Part were liberated in the cane on the Station grounds, and part in the cane at Waipio, where there was an infestation by cane aphis.

No. 293, November 14th. Puparia of *Haematobia stimulans.*

During the following three weeks six female and three male *Figites* emerged; three female and two male *Bathymetis;* and one *Alysiid.*

Nos. 294-299, November 29th.

Puparia of several species of flies collected in different localities in Switzerland. Scattering along through two months the following parasites emerged:

Figites, 23 females and 18 males;
Bathymetis, 14 females and 30 males;
Alysiid, 1 male;
Unknown species, 1.

Some of these were liberated and some were placed in cages in further attempts to breed them but without success.

Nos. 300-301, December 20th. Puparia of *Haematobia* and *Hylemyia.*

From these in January, three female and one male *Figites,* and one *Spalangia* emerged.

No. 302, December 27th. Puparia of Housefly and *Stomoxys.* But one female and one male *Bathymetis* emerged.

No. 303. Sent the same time as No. 302 but failed to arrive.

O. H. Swezey.

RECORD OF THE HORNFLY PARASITE MATERIAL RECEIVED FROM MR. KOEBELE IN EUROPE DURING 1912.

During 1912 Mr. Koebele continued further researches on *Hymenopterous* parasites of hornfly in Europe, giving attention chiefly to *Cynipid* (*Figites sp.*) which he had sent the previous year, but which had failed to establish, on account of the very small numbers that emerged simultaneously for liberation from the material sent, and that the entomologists were unable to breed any of them in cages.

The material sent in 1912 was in further attempts to establish this parasite here. The records of the shipments received, date of receipt, etc., follows:

No. 305, received September 17, 1912. 266 puparia of *Haematobia stimulans.* Numerous flies had emerged and died before arrival; 44 flies emerged Sept. 18 to October 12. No parasites emerged. November 14 the few remaining puparia were examined and found to contain dead flies.

Nos. 306 and 307. Received September 23. 451 puparia of *Haematobia stimulans*. A great many flies emerged and died before arrival. One female *Figites* emerged September 28. 41 flies emerged September 27 to October 12. November 14 the few remaining puparia were examined and found to contain dead flies.

No. 308. Received October 26. 106 puparia of *Haematobia stimulans*. Some flies emerged and dead on arrival. 62 flies emerged October 31 to December 12. No parasites emerged.

No. 309. Received October 26. 106 puparia of *Haematobia stimulans*.. Some flies already emerged and dead on arrival. 62 flies emerged October 31 to December 12. No parasites emerged.

No. 309. Received October 29. 56 puparia of *Morellia hortorum*. Some flies had emerged and died before arrival. 9 flies emerged November 9th to December 6th. No parasites emerged.

No. 310. Rceived October 28. 38 puparia of *Hebecnema umbratica* and 25 puparia of *Hylemyia sp.* Some flies had emerged and died before arrival. 7 flies of the former species and 15 of the latter emerged October 30 to December 15. No parasites emerged.

O. H. SWEZEY.

Since the last report was received, the following communication has been sent to the President of the Board of Agriculture and Forestry by Mr. O. H. Swezey, Acting Entomologist of the H. S. P. A. Experiment Station, giving further notes on Hornfly work and observations:

Honolulu, T. H., Jan. 14, 1913.

Mr. W. M. Giffard,
Pres. Board of Agriculture and Forestry,
Honolulu, T. H.

DEAR SIR:—Since writing you and enclosing reports on Prof. Koebele's Hornfly work for 1911 and 1912, we have received a letter from him, the substance of which you might like to append to the 1912 report.

Under date of December 18, 1912, he writes: "This has been a most unusual season and I did not expect any results from material sent. During two months, August and September, continuous rain, with the exception of three days. When I collected during August, larvae of *Haematobia* were rather abundant. All had changed in September when rain finally ceased. Larvae of

Haematobia were very few and but rarely present in dung dropping. The weather had become cold; ice and frost in the morning. In fact it became so cold toward the end of September, the temperature came down to six points below zero (Celsius) and animals had all to be removed from the summer pasture.

"I visited other parts during October, yet hardly traces of the looked for flies could be found. Other species, especially *Polietes lardaria,* were still present and breeding. It may be of interest to mention that here crows were abundant, and most of the older manure, where puparia could be expected, had been scattered in all directions by these birds, even the grass and moss was torn up, I expect in search of larvae of *Aphodius* and related species. Not in one instance during these collecting trips did I meet with a single parasite, formerly so often seen. On top of it all I contracted a severe cold during September, and after the October collecting I had been laid up in bed for a time. Very sorry the collecting south of the Alps had to be abandoned."

Yours truly,
EXPERIMENT STATION, H. S. P. A.,
by OTTO H. SWEZEY,
Acting Entomologist.

THIMBLEBERRY.

In the last report of this Division, for 1909-10 (pp. 137-138), mention was made of the presence on the island of Hawaii of an introduced raspberry (*Rubus jamaicensis*) which from its rapid spread was proving a pest on the pasture lands. In an effort to control the further spread of this plant, particularly to the other islands of the group, the Board of Commissioners in January, 1912, passed a rule and regulation, No. XIII, which is given herewith. Representatives of the Board are doing all that they can under present conditions to see that the terms of this rule are enforced, especially as regards the transportation of plants from districts where it is now established.

RULE XIII.

Rule and Regulation of the Board of Commissioners of Agriculture and Forestry, Concerning the Control of the Plant Pest, Thimble-Berry in the Territory of Hawaii.

The Board of Commissioners of Agriculture and Forestry hereby make the following rule and regulation:

Section 1. For the purpose of controlling and as far as possible of preventing the further spread of Thimbleberry (**Rubus jamaicensis**), called also Olaa Raspberry, and Hitchcock Berry, a plant introduced

into this Territory at a point near Hilo, Hawaii, and now known to be established on various parts of the Island of Hawaii and in the Koolau and Hana Districts, Maui, which, by reason of its habits of growth and ease of propagation has become in certain parts of the Territory a serious pest, especially on grazing land, all persons and corporations are hereby prohibited from carrying or shipping any plant, root, cutting, fruit or seed of the said Thimbleberry from one Island of the Territory to any other Island; provided, however, that shipments of such Thimbleberry plants which are infected with a fungus disease may be made by duly authorized agents of the Board of Agriculture and Forestry for the purpose of inoculating healthy Thimbleberry plants with said disease.

Section 2. For the purpose of eradicating and preventing the spread of Rubus jamaicensis, Inspectors and other duly appointed agents of the Board of Agriculture and Forestry are hereby empowered to enter at all reasonable times any and all premises throughout the Territory where the Thimbleberry is known or believed to be growing, and such agents are also hereby empowered, if plants of Thimbleberry are found thereon, to seize and remove the same and to have them destroyed.

Section 3. Any person or corporation violating the above rule shall be guilty of a misdemeanor, and shall be punished by a fine not to exceed Five Hundred Dollars as provided by Section 390 of the Revised Laws of Hawaii as amended by Act 82 of the Session Laws of 1905 and Act 112 of the Session Laws of 1907.

Section 4. This regulation shall take effect from and after the approval thereof by the Governor.

Approved:

W. F. FREAR,
Governor of Hawaii.

Honolulu, Territory of Hawaii, January 31, 1912.

FEDERAL HORTICULTURAL BOARD.

Mr. C. L. Marlatt, Chairman of the Federal Horticultural Board, while visiting the Islands saw the advantage of combining the duties of Territorial and Federal inspection of imported nursery stock, fruits, etc., thereby preventing duplication and overlapping of Government work. After consulting with Mr. W. M. Giffard, President of the Board of Agriculture and Forestry and the Superintendent of the Division of Entomology, it was decided that the appointment would not interfere with the work now performed by my Division, in fact having the backing of the Federal Government, it would rather strengthen the work. Accordingly, on his return to Washington, Mr. Marlatt recommended to the Secretary of Agriculture the appointment of the Territorial Superintendent of Entomology as deputy quarantine inspector under the Federal Plant Quarantine Act of August 20th, 1912. On December 1st, 1912, I received my appointment as Collaborator of Nursery Plant Inspection and Quarantine.

RECOMMENDATIONS.

Owing to the steady increase of all shipping which includes shipments of fruit, vegetables and plants arriving in the Territory the need for further equipment for the Division of Entomology to handle these shipments is very necessary. Now that the Panama Canal is almost completed, we shall have direct communication with Central America, Mexico, the West Indies and several South American countries. Some very serious pests exist in these countries and we must look ahead and provide sufficient funds so as to be able to employ more assistants as well as to provide for laboratory and fumigating rooms. This matter should be seriously considered by the administration.

The necessity for establishing an up-to-date inter-island inspection is very important. Now that Honolulu, the port of entry of all the Islands is to increase her shipping through the completion of the Panama Canal, we are face to face with entirely new problems. Should any pests be accidentally introduced here, we could by having the proper inter-island inspection, keep these pests from gaining a foothold on the other Islands for a long time. A very liberal appropriation will be necessary to establish the proper system and should be thoroughly considered by the Board of Commissioners for presentation to the Legislature.

In my report for the year 1910 I drew attention to the numerous complaints received from growers and residents of the damage caused by the Melon-fly, Alligator-pear mealy bug, Japanese beetle, and other serious pests. These complaints have continued to come to the office and I would recommend that the Board of Commissioners take cognizance of the necessity of keeping up the introduction, propagation and distribution of such parasites as would tend to relieve the serious loss caused by them. Adequate provision should be asked for to enable the building of an up-to-date Insectary and provide for an assistant to do the work.

Respectfully yours,

EDW. M. EHRHORN,
Supt. of Entomology.

Plate 21. Dog Quarantine Station, Honolulu.

Division of Animal Industry.

LETTER OF SUBMITTAL.

The Board of Commissioners of
Agriculture and Forestry,
Honolulu, Hawaii.

GENTLEMEN:—I have the honor to submit herewith a report on the work of the Division of Animal Industry of the Board of Agriculture and Forestry, for the biennial period ending December 31, 1912.

Contrary to previous usage I take the liberty to submit this report over the name of my Assistant, Dr. Leonard N. Case, in conjunction with my own, in recognition of faithful work and results attained. I have special reference in this regard, to the bovine tuberculosis control work, which has been the main object of our efforts, and which at the present time seems promising of success in so far, at least, as the extension of the work to include the entire Territory is concerned. The dairy herds of the City and County of Honolulu, and the range herds from which many of these are constantly being supplied with fresh cows, will undoubtedly show less than two per cent of reacting animals when they are again tested, and this percentage must be expected to remain but slightly varying for the next few years, or until the sanitary and hygienic conditions of all dairies have been improved up to the point where no more animals will become infected from their inanimate surroundings.

BOVINE TUBERCULOSIS.

As will be discussed fully in this report, the complete eradication of bovine tuberculosis from any country, state, territory or even district has never yet been accomplished except through material assistance in the way of indemnification for diseased animals destroyed by the authorities undertaking the work. It would therefore seem but just, that the unselfish sacrifice by the dairymen of the City and County of Honolulu, of hundreds of valuable animals, for many of which the owners did not even receive the value of the hides and offal, but which were simply destroyed in order to be able to offer to the consumers *clean milk from a clean herd,* should be appreciated by the public by lending their aid in obtaining from the coming Legislature an appropriation insuring a reasonable remuneration for any dairy animal which in the future is found to be infected with tuberculosis, and which therefore must be sacrificed for the benefit of the community. The dairymen of the City and County of Honolulu have, up to this time, sacrificed animals which could not be replaced for less than $100,000.00, that is, practically every animal which was pointed out to them as a possible source of tuberculous infection to human beings, and especially to children. And this was done without any hope or promise of indemnification, and with but a slight temporary increase in the price of milk; but as many of them have been unable, at the same time, to keep abreast with the modern requirements for sanitary stables and hygienic surroundings so essential for keeping a once clean herd free from renewed infection, or even to effect a thorough eradication of the infection from old and perhaps delapidated premises, it would as stated, seem only just, that the continued struggle against this appalling scourge should be encouraged by official (territorial or municipal) assistance, in all cases where the owner has shown, by spirit and action, his earnest endeavor to produce wholesome milk from a healthy herd. If at the same time a measure was enacted, such as recommended by the Sanitary Commission of 1911, making it unlawful to sell milk from dairy animals that have not been proven by the tuberculin test to be free from tuberculosis, then there would be every reason to expect that the disease would be completely eradicated, as those who had already done what they could to clean their herds would have no hesitancy in continuing the work, knowing that any further losses would be borne, at least partially, by the public; while those who had not been so inclined would either have to come in line at their own expense, or go out of business. This may sound harsh, but when the facts are all considered, there would be few if any who would not be benefitted by such a statute. In most of the States on the Mainland where actual efforts are being made to control bovine tuberculosis it has been left to the individual dairy owner to choose for himself whether he wants to clean his herd or not, the State authorities doing the testing, appraising the reacting animals and if the owner so elects destroying them and indemnifying him to the extent of one-half of the actual loss on each animal. For instance, a cow reacting to the test is appraised at $70.00, is butchered under competent inspection, the carcass is passed as fit for human food, bringing perhaps $30.00, which goes to the owner. The difference of $40.00 is divided evenly, the public standing half of the loss and the owner the other half. In this case the owner realizes $50.00 wherewith to assist him in obtaining a sound animal in the place of the diseased one. On the other hand, had the reacting animal been so far advanced in the disease as to require the condemnation of the carcass, the owner would realize only the value of the hide and offal, minus expenses—perhaps $5.00. In that case the actual loss would be $65.00, half of which, or $32·50, would be borne by the public, the owner realizing a total of $37.50. He would, however, have the satisfaction of having gotten rid of an animal that could not have lived much longer and which would have been a constant menace to the health of his other cows, not to mention the danger of infecting human beings through the milk.

Under the same statute an animal which shows physical symptoms of tuberculosis, and especially emaciation, or one in which the udder has become affected, is destroyed as a menace to public health, and no indemnity paid, unless the owner elects to have the entire herd tested, as above described, that is, accepting government supervision with a view to complete eradication of the disease.

A few years ago (1909) the federal Bureau of Animal Industry, one of the most important branches of the U. S. Department of Agriculture, decided that bovine tuberculosis ought not to be tolerated in the immediate surroundings of its headquarters, Washington, D. C., and to quote the report of the chief of the said Bureau in his report for the year 1910:—"the belief that a demonstration of the practicability of eradicating bovine tuberculosis from a given area would be of material benefit by the encouragement which it would give and by outlining working methods to accomplish successful results, the District of Columbia was selected for the purpose, and a co-operative arrangement was entered into with the Commissioners of the District."

The result of this was an "executive order" issued under date of November 26, 1909, and entitled "Order of the Commissioners of the Distrtict of Columbia for the Suppression and Prevention of Tuberculosis in Cattle."

Under this order all the cattle in the District of Columbia, numbering 1701, were tested with tuberculin, and of these 321, or 18.87 per cent., gave reaction. All of the latter were slaughtered under inspection, and all except a few belonging to the Government, were appraised, and the owners reimbursed. In nearly 77 per cent. of the carcasses the lesions were found so slight and localized as to permit of the use of the meat for food, while the remainder were more or less generalized cases and were entirely condemned. The average appraised value of the reacting cattle was $45.41, while an average price of $18.88 was obtained from their sale, the Department of Agriculture reimbursing the owners to the extent of an average of $13.97 for each animal, making the average loss to owner $12·56 per cow, based upon the appraised value.

It is needless to say that these figures cannot be accepted as a basis for a similar procedure in this Territory. The average price of a good, young milch cow ranges here between $75.00 to $100.00, depending upon the quantity of milk given by each when fresh and at the time of sale, as well as upon the breed and physical condition. This great difference in price is the natural outcome of the difficulty of growing feed for dairy purposes here in sufficient quantities to allow of raising dairy cattle as such. They must therefore be raised either on imported, purchased feed, or else allowed to grow up as range cattle. In the first case the price of a 10-quart heifer is doubled, in the second the result is a 5-quart heifer. In either case the consumer must pay at least 10cts. per quart for milk if there is to be any profit in the dairy business. On the other hand, the returns from butchered reactors may be expected to be considerably in excess of those obtained in the East, in fact nearly double that price. If therefore the Board should decide on approving the plan here suggested and recommend indemnification of owners of tuberculous cattle after they have once cleaned their herds of reactors, it is believed that double the prices and values from the District of Columbia, for appraisal and reimbursement, will be required unless the loss to the owner shall be more than doubled.

As emphasized in other parts of this report, and as iterated and reiterated in previous reports, the great mortality from tuberculosis in the Territory, and especially the appalling infantile mortality—as most forcibly pointed out by Dr. Elliot in his appended report, 107 per thousand in the slums of London and Birmingham, and 347 per thousand in the Paradise of the Pacific—makes it compulsory that *the one known source of tuberculous infection, which can be controlled, that is, the tuberculous cow and its milk, be eliminated.* This can be done, but only by placing the matter in the charge of a territorial department, instead of having it as at present in charge of two territorial and four municipal boards.

Strange as it may seem, in one way our splendid climatic conditions tend to work a hardship, that is, in prolonging the life and checking the development of the disease in tuberculous cattle. This condition, while beneficial to the same extent in so far as human patients are concerned, tends to minimize the danger of infection from apparently sound but still dangerously infected animals, the diseased condition of which can only be demonstrated by means of the tuberculin test, while under more unfavorable conditions they would develop the acute form of the disease and either die or be destroyed in short order. An owner of a dairy herd cannot be blamed for objecting to the destruction of an apparently sound animal, for even though it is proven that it may be scattering tubercle bacilli by the million every day it still continues, for years perhaps, to be profitable as a milk producer. For this reason, if for no other, bovine tuberculosis is the one disease for the eradication of which the owner should be indemnified by the public.

So far as can be estimated at the present time, the number of cattle which may still be found infected with tuberculosis on the Island of Oahu may possibly reach 200. Placing the average indemnification sum at $25.00 per head, the total sum required would be $5,000.00. On the other Islands, where the tuberculosis control work is only in its infancy, a considerably larger number of reactors will undoubtedly be found, but if the owners are to be reimbursed only to the same extent as on Oahu, that is, only after their herds have once been cleaned of tuberculous animals at their own expense, then a similar sum—$5,000.00—should be sufficient to keep the disease in complete control in each of the other counties, or a total of $20,000.00. To this must be added the expense of administering the test, supervising appraisal, segregation, destruction and disinfection. This can be accomplished satisfactorily by giving the four deputy territorial veterinarians a salary of $100.00 per month and paying them a certain mileage when engaged in tuberculosis control work. This would require $400.00 per month, or $9,600.00 for the biennial period, and with $5,600.00 for expenses it may be estimated that bovine tuberculosis can be eradicated from the entire Territory at a total cost of $35,000.00.

After that has been accomplished it should devolve upon the Territorial Veterinarian and his deputy to keep the disease excluded and suppressed at such salaries as may be allotted to them by the Territory or the Counties.

GLANDERS.

When the Division of Animal Industry was added to the Board of Agriculture and Forestry in 1905, glanders prevailed throughout the Territory. Hundreds of cases have been located and destroyed and the infection obliterated, while the introduction of fresh centers of infection has been guarded against by strictly enforced rules and regulations for the inspection and testing of all horse stock before admission to the Territory. With a single exception no outbreak has occurred for more than two years, and this outbreak, owing to the almost completely isolated locality where it occurred, Waipio Valley, Hamakua, was easily dealt with, and no apprehension is felt as to its further spread. Its suppression required, however, the destruction of 34 head of horses and mules, all of which were proven to be infected with glanders, and the complete destruction and relocation of stables and yards. As all of the animals in question belonged to one man, and as no precedent existed for the destruction or confiscation of such a number of animals or property without compensation and purely for the benefit of the community, action was taken by the neighboring plantations, ranches and other owners of horse stock to assist the owner to obtain other work animals, without which he would be bankrupted, and with a view to obtaining relief for him through indemnification by the next legislature.

For this reason all of the animals were first appraised, in accordance with the rules governing such procedure in countries where indemnification is paid, the three appraisers being duly sworn. As a glandered animal has no legal value, the law requiring that it must be destroyed, these animals were appraised without regard to the specific infection, the value being based upon age, conformation and physical condition, each appraiser writing the estimated value on a piece of paper, initialing it, and handing it to the Territorial Veterinarian· The sum total for the 28 animals amounted to $1765, or an average of $63.00 per head, which it is recommended the owner be reimbursed by the Territory. The details of this outbreak and all that pertains to the quarantine, testing, appraisal, destruction and disinfection will be found under the chapter on "Glanders" in the report.

As this undoubtedly is the last vicinity where glanders may be found in the entire Territory, unless it be in some equally out of the way place, it is strongly recommended that the coming Legislature should recognize glanders as a disease the eradication of which should be encouraged by a promise of indemnification in all cases where the owner reports a suspicious case and submits it for examination to the proper authorities. It is fully believed that the sum of $1,000.00 set aside for this purpose, will bring forward any obscure case which may have been kept hidden or turned out, and that it will encourage horse owners to keep on the lookout for the disease. If at the same time a reward could be offered leading to the apprehension of such cases there is little doubt that the Board will be able to report the complete eradication of the disease before the end of 1913.

RABIES.

The next disease of importance with which this Division has had to deal during the past period, though fortunately so far only at a distance, is rabies or hydrophobia. This disease has spread to an alarming extent, during the past few years, all over the United States and in many foreign countries, and as described elsewhere in this report its introduction into this Territory would prove little short of a calamity. So when the disease reached the Pacific Coast, the Board took every measure possible to prevent its gaining entrance here through the many dogs which arrive with tourists or are imported here annually. The stringent regulation requiring the absolute segregation in quarantine of all dogs for 120 days before admission to the Territory, has proven the most annoying problem the Division has had to deal with so far, and has failed, as was expected, to cause any very great reduction in the number of dogs brought in (106 as compared to 134 the year before).

In concluding I have the honor to call especial attention to the appended reports by the Assistant Territorial Veterinarian and the three Deputy Territorial Veterinarians. That the Territory is as free from disease among live stock, and especially that glanders has been practically eradicated is entirely due to their efforts and vigilance, and it is characteristic that the last outbreak, as referred to before, occurred in the only district where no deputy is located. Their value to the live stock owners and the industry is however to a great extent dependent upon their ability to reach their patients and to check an outbreak, without delay, and much of their earnings must be expended for transportation. With the distances they have to travel and with the condition of the roads, in many districts almost impassable in rainy weather, a considerable portion of their income must be spent for transportation.

It is therefore again recommended that they be paid a subsidy by the Territory somewhat commensurate with the services rendered and which it is believed from the action of the last legislature must have met with the approval of those employing them.

Respectfully submitted,

VICTOR A. NÖRGAARD,
Territorial Veterinarian.

Honolulu, Hawaii.
December 31, 1912.

Report of the Territorial Veterinarian

for the

BIENNIAL PERIOD JAN. 1, 1911, TO DEC. 31, 1912.

By

VICTOR A. NÖRGAARD, V. S. *(Copenhagen)*,
Superintendent of Animal Industry,
Territorial Veterinarian,
and
LEONARD N. CASE, D. V. M. *(Cornell)*,
Assistant Territorial Veterinarian.

THE LIVE STOCK INDUSTRY OF THE TERRITORY

In my report for the fiscal year ending June 30, 1909, the live stock industry of the Territory was discussed at some length while the 1910 and 1911 reports refer to this subject only in the form of comments on the facts and figures of the former. As this industry seems to be undergoing considerable changes, and especially as the question of supply and demand has been greatly altered by the sudden increase in the meat consuming population, due principally to the stationing of large contingents of military forces within the Territory and partly also to the constantly increasing tourist traffic, it would seem appropriate here to discuss the live stock industry at some length. If the Territory, or even the Island of Oahu alone, is to be made a military stronghold, the question of subsisting without access to food supplies from the outside may become of importance.

Previous to the military invasion the situation was briefly as follows:

With the exception of dairy and poultry products the Territory seemed well able, under normal circumstances to supply the local demand for all meat food-products such as beef, mutton and pork. Beef especially was abundant, even though the number of cattle estimated in my 1910 report at 130,000 head, undoubtedly was in excess of the actual number present. Since that time, however, a considerable decrease has taken place, and even though the actual figures as secured by the last census are not yet available, it is safe to say there are at present considerably less than 100,000 head of cattle in the Islands. On the other hand this reduction in numbers has to a great extent been offset by the increase in quality which has taken place during the past few years, principally through the introduction of large numbers of pure-bred breeding animals, but also by the application of

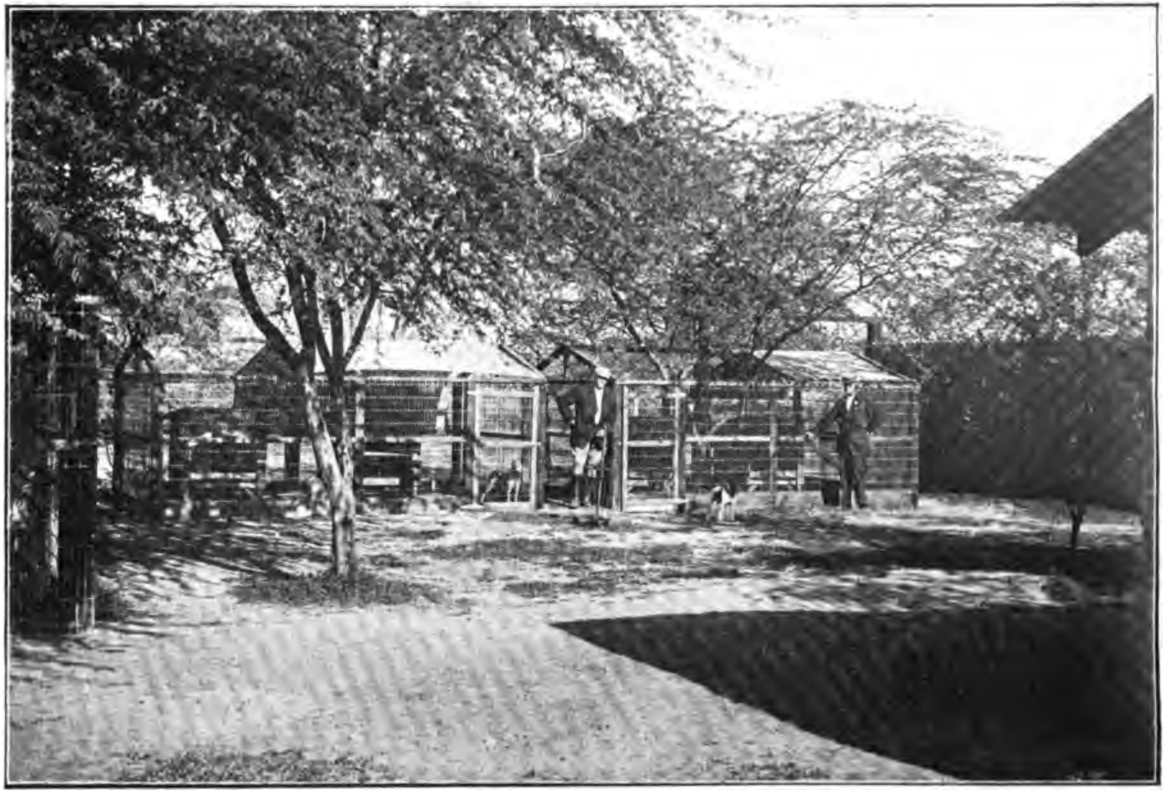


Plate 22. **Dog Quarantine Station, Honolulu.**

modern scientific methods of selection, feeding and handling. As a result the four-year-old steer, which used to be the rule, has nearly disappeared, all the improved and well bred steers maturing at or before the age of three years, thereby alone offsetting a twenty-five per cent. reduction in numbers. That the quality of the beef and the value of the dressed carcasses have increased is illustrated by the following figures obtained from the leading slaughter house in Honolulu:

	No. cattle killed.	Average weight per carcass.	Average price per cwt. dressed.
1909-1910..............	8,403	lbs. 449	$9.77
1910-1911..............	8,746	" 451	9.78
1911-1912..............	10,013	" 490	9.96

This shows that on a total of more than ten thousand head killed during the past year, an increase of 41 lbs. per carcass or an aggregate of over 400,000 lbs. which is due solely to improved breeding and care. The increase in price is less apparent except when considered in connection with the earlier maturity.

In 1909 it was estimated that the total consumption of beef was about 15,000 carcasses per annum, of which number approximately 60 per cent. was used in the City of Honolulu. During the fiscal year 1911-1912 there were killed in Honolulu between 10,000 and 10,500 head of cattle or approximately 16,500 head in the Territory. Besides this there was imported 530,000 lbs. of beef of which approximately 90 per cent. came from Australia and the rest from California. This imported beef is consumed principally by the enlisted men in the Army whose daily allowance is twenty ounces of fresh meat per man. It is therefore obvious that with the shortage of native cattle and the constantly increasing population the Islands will be obliged to import beef in much larger quantities than hitherto. It is estimated that considerably more than 1,000,000 lbs. of beef will have to be imported during the coming year.

In 1909 it was estimated that there were about 100,000 sheep in the Islands which under favorable conditions should have been sufficient to supply a demand of about 1,200 sheep per month. For some reason, however, sheep raising, and especially for mutton production has received the cold shoulder, and it is doubtful whether there is today much over 80,000 sheep in the Territory. During 1911-12 there were killed in Honolulu 9,200 sheep, the carcasses of which averaged less than 35 lbs. in weight. Various diseases, mostly of parasitic nature, in connection with overstocking of ranges, have been the principal factors in the diminishing of the flocks.

While the demand for island mutton has remained unchanged the constant presence in the local markets of imported mutton, which as a rule is of prime quality and retails at the same price as the native product has caused the local consumers to overcome a certain prejudice against frozen or chilled mutton, which seemed to exist. Many of the consumers have found it more profitable to purchase the imported mutton because the carcasses are larger, averaging 45 to 50 lbs., and the waste consequently, is less.

With the exception of a few desultory importations of rams from New Zealand and California about equally divided between mutton and wool breeds, little has been done for the sheep industries and with the constantly increasing demand for beef at better prices it is probable that sheep raising will continue to decrease, at least so long as the foreign markets remain accessible to the local packers and dealers. To combat the various pests which harass this branch of the live stock industry requires considerable outlay of money not alone in the treatment and care of the animals, but also in guarding and protecting the pastures where sheep are run, as the former, unless properly fenced and allowed to rest from time to time soon become exhausted, if not irredeemably destroyed by these close cropping feeders.

Where Merino rams have been introduced and where the fleeces can be kept free from burrs, the wool produced is of good quality and brings good prices. But here again, the distance from market often causes losses and it has been found more profitable to breed for mutton by crossing with Shropshires and Southdowns and accept the lower price for the inferior wool, but get a heavier carcass than the one resulting from the Merino cross.

For the past few years there has been imported in the neighborhood of 400-500 carcasses of mutton monthly. For the year 1911-12 the total weight was 152,000 lbs. of mutton as compared to 155,000 lbs. in 1910-11 and 244,000 lbs. in 1909-10.

The large Oriental population, and especially the Chinese, consume great quantities of pork. Up until 1909-10 there were imported from 5,000 to 7,000 butcher hogs annually from California. The very high prices resulting from a scarcity, due to hog cholera in California, gave a certain impetus to hog breeding in the Islands, and in the course of a very few years sufficient hogs were raised here to supply the entire demand. The climatic conditions seem to be everything that can be desired for hog raising and the dreaded hog cholera appears to affect the animals in a very mild form only.

Draft horses and mules for heavy agricultural work are still being imported at the same or even greater rate as during the preceding years, but there is now prospect that before very long the Territory will be able to supply at least part of these animals.

On the Island of Hawaii a considerable number of large mares have been raised by the use of imported Percheron and Shire stallions. These mares are now being bred to imported Kentucky jacks and as the high mountain pastures contain a great variety of nourishing grasses and the cool climate is ideal for the purpose there is every prospect of mule raising being added to the live stock industry of the Territory.

An abundance of saddle horses are being bred in the Islands, and have found favor with the local military authorities as mounts for cavalry.

A transaction of considerable import to the local live stock industry took place recently when a considerable number of island bred horses were purchased for cavalry mounts to be used by the forces stationed here. Though the matter has been under consideration for a long time and was highly recommended by the officers stationed here and who had learned to appreciate the high spirited surefooted native horses, it seemed that there were insurmountable obstacles emanating from elsewhere, until suddenlv the barriers were let down. The horses purchased were all bred on the Parker Ranch on Hawaii and it is confidently expected that these horses will prove so satisfactory as to establish a demand for many more at remunerative prices.

IMPORTATION OF LIVE STOCK.

The following different classes of live stock have been received into this Territory through the port of Honolulu during the period of 1911 and 1912:

	Horses	Mules	Cattle	Sheep	Swine	Dogs	Cats	Poultry (crates)
1911*...........	753	625	86	133	13	132	4	392
1912*...........	411	677	70	36	34	106	10	595

HORSES.

Almost half the number of horses imported during the past two years, in actual figures the number being 500, were consigned to the various branches of the United States Army stationed here. Of the remaining number the majority were horses of light and heavy type brought down by the various importers of stock for work in the city and outlying districts, and for which there seems to be a continued demand.

A number of stallions of the German Coach, Belgian and Clydesdale type have been imported during the past two years. These importations should be continued and every encouragement given to bringing such animals into the Territory as it is by such means that improvement of the various types will take place and enable the different ranches to supply the demand for such animals.

---

* For importations through the port of Hilo see p. 222.

MULES.

During the past two years the number of mules imported into the Territory has increased to almost double what it was at the end of 1910. This perhaps is due to the plantations holding back their orders for a hoped for decline of prices on the mule market. The prices on the different markets for good mules have remained firm and there is little hope for a material decline while the supply and demand remains as it is.

Six exceptionally fine Jacks have been imported by Mr. A. W. Carter for the Parker Ranch for the purpose of mule breeding. It is to be hoped that this industry will make rapid strides and that in a comparatively short time the large ranches will be in a position to supply, in part at least, the demand of this Territory for this valuable class of work animals and keep in circulation within the Territory a large part of the thousands of dollars which are annually being expended in the purchase of mules from the Mainland· The Parker Ranch at least is in a position at the present time to breed a high class of mules and every encouragement should be given to promoting this important industry so long advocated by this Division.

CATTLE.

The number of cattle imported during the last biennial period has fallen considerably below that of the single years of 1909-1910. While this is true of numbers the high standard of quality has been maintained.

Three breeds principally have been imported, namely Herefords, Shorthorns and Holsteins. The Parker Ranch has been conspicuous in its importations of blue ribbon, prize winning Hereford bulls and heifers.

Of the dairy breeds the Holsteins led by a large majority, Mr. Isenberg the largest dairyman in the Islands, having alone imported many of the highest class bulls and heifers of this breed. There cannot be too many of this excellent breed brought in here as the great need of high class dairy animals is very apparent.

SHEEP.

The two principal breeds imported have been Shropshires and Merinos, and in numbers have fallen below that for the biennial period of 1909 and 1910. The demand for a superior quality of mutton still remains far in excess of the supply and much still remains to be done in the improvement of the different breeds existing in thees Islands. By the continued importation of high class breeding stock alone can the standard of quality of the various flocks be raised and an animal of hardy constitution, superior carcass and clip be produced.

SWINE.

The importation of swine total less than fifty and have been principally Berkshires with a few Hampshires, all pure-bred breeding stock. For some time now, in fact since 1909, the demand of the territorial pork markets has been entirely supplied by home production. The pork produced here is of a superior quality and the character of the importations of breeding stock points to a continuation of this high standard of production.

POULTRY.

Each year sees an increasing number of poultry of all classes imported into the Territory. Nine hundred and eighty-seven (987) crates were brought in during the biennial period of 1911-12 as against six hundred and eight-eight (688) crates for the years 1909-1910 or an increase of nearly three hundred crates.

The importations include nearly all classes of poultry with a preponderance of white leghorns, plymouth rocks, white and barred, and Japanese games.

With the constantly increasing market demand for superior table fowls and fresh eggs, combined with ideal climatic conditions and almost no infectious diseases to contend against, this Division confidently anticipates the time when poultry raising in these Islands will become a recognized industry and a considerable source of income to the small farmer.

THE HILO AND KAHULUI QUARANTINE STATIONS.

As indicated in the appended reports of both of the deputy territorial veterinarians for Hawaii and Maui, there is urgent need of adequate premises for the quarantining of animals at both of these ports of entry where ocean liners arrive regularly, and where the records of the last few years show that large numbers of live stock are imported.

Sites for such quarantine stations have now been acquired by the Board and plans and specifications are ready, so that it may safely be predicted that the stations will be built and ready for use in the course of a few months.

So far as Hilo is concerned, the Board has acquired part of the old Shipmen Slaughterhouse pasture near the Waiakea Mill, on the Volcano road, about one mile outside of Hilo, while at Kahului a suitable piece of ground, near the railroad track on the way to Spreckelsville, has been ceded to the Board for quarantine purposes.

The number and value of the domestic animals that are being imported in ever increasing numbers, warrant that every facility be provided and every encouragement offered the importers, as every drop of pure blood brought into the Territory from without, with high class and thoroughbred stock will leave its mark, not alone upon the importers' stock, but upon the live stock of the entire Territory. At the same time it should be kept constantly in mind that this Territory is blessed by the absence of nearly all of the animal scourges that cost the United States, as well as foreign countries, billions of dollars annually, and that every dollar spent in preventing their entrance here is thousands of dollars saved; and there is no safer or surer way of preventing their entrance here than by the careful observation of all imported animals in sanitary and hygienic quarantine stations, before admitting them to mingle with the herds and flocks of the Territory.

MEETING OF THE AMERICAN VETERINARY MEDICAL ASSOCIATION AT TORONTO, CANADA.

The vast importance of controlling the animal diseases which are transmissible to man, especially bovine tuberculosis, glanders, rabies and many parasitic diseases, necessitates that every official charged with the conservation of the health of food producing animals, and thus more or less directly of public health, shall keep informed on the progress of live stock sanitary science. Realizing that this cannot be accomplished in any better way than by attendance at meetings where gather the foremost authorities for the purpose of discussing new methods, theories and results of observations on the subjects of veterinary medicine, hygiene and sanitation, the Board decided to delegate the writer, (V. A. N.), to attend the above mentioned meeting. The following is a concise account of the proceedings as well as of the results derived from an exchange of observations with scientists from many parts of the United States and Canada.

On the morning of August 22nd I arrived in Toronto. The meeting opened the same day at 10:00 a. m. and was attended by nearly seven hundred veterinarians, sanitarians and scientists from all parts of the United States and Canada. The Federal Bureau of Animal Industry was represented by its chief, Dr. A. D. Melvin, together with a number of heads of the various divisions of which the Bureau is composed.

Contrary to the previous meeting the subject of bovine tuberculosis did not receive the consideration which was expected by all sanitary officers present, and it would in fact appear that the

International Commission on Bovine Tuberculosis had completely exhausted itself with its previous, and now world famous, effort. Only the section on Education presented a "Primer on Tuberculosis," consisting of a plain but lucid description of the disease, its nature, cause, manner of transmission and economic importance, and told in language with a total absence of scientific or technical terms.

This primer was later published by the United States Department of Agriculture as a "Farmers' Bulletin," and, through the courtesy of our Representative to Congress, two hundred and fifty copies were secured and distributed among the dairy men, farmers, milk dealers and all others in any way connected with the cattle industry, whether for dairy or beef purposes·

The Intradermal test with which we have obtained such good results here, was hardly more than mentioned though some work had been done in an experimental way with it at the Experiment Station of the Bureau of Animal Industry, near Washington, D. C. The number of tests made were, however, absolutely insufficient to lead to any definite conclusions and when a few doubtful reactions were met with, even though admittedly due to faulty technique, the method was at once concluded to be less reliable than the subcutaneous one, and its great advantages of simplicity and cheapness were lost sight of. I did, however, whatever was possible to prevent the official relegation of the method to the junk heap and succeeded in interesting a number of the leading sanitarians, including the chief of the Bureau of Animal Industry, and to obtain their promises of exhaustive experiments with, and further investigation of, the method. I was also promised that the Bureau will prepare and furnish us with the special tuberculin required for the test, free of charge. The work which has been performed here with the eradication of bovine tuberculosis was highly commended, and its continuation encouraged with the promise of every assistance which it is possible for the Federal Bureau to lend in the matter.

A number of papers pertaining to municipal and state dairy inspection, as well as to dairy farm inspection and the sanitary production and handling of commercial milk, were read and fully discussed, and many useful hints for the improvement of our local dairy industry were gathered.

Glanders in horse stock and red-water in cattle came in for special attention, Canada having nearly succeeded in eradicating glanders since voluntarily reported cases are being paid for when destroyed under official supervision.

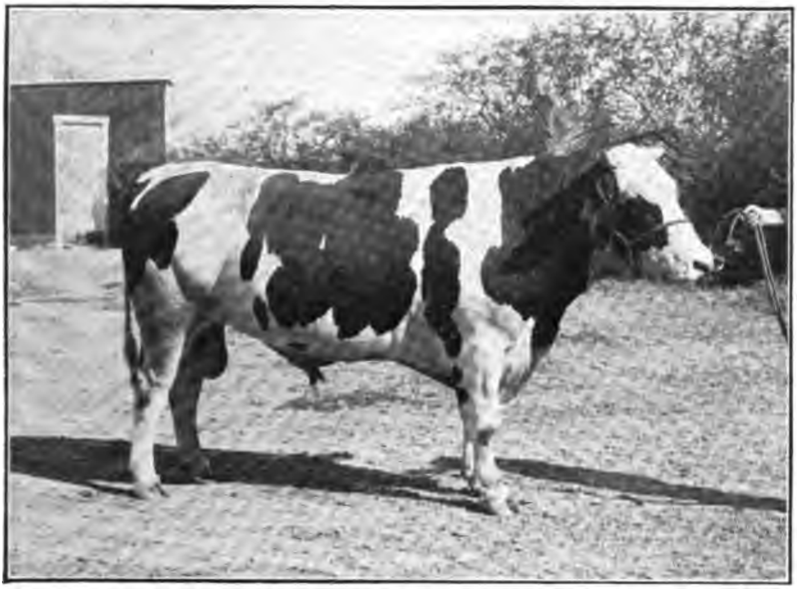
From Toronto I went to Washington, D. C., where I spent a week in the pathological laboratories of the Bureau of Animal Industry, as well as in the dairy and quarantine divisions, learn-ing new methods and getting new ideas. The officials of the Bureau appreciate the progressiveness of the Board in equipping the Division of Animal Industry with all modern facilities for the control of live stock diseases, especially on account of the constant danger of the introduction of either of the great animal scourges of the Orient—rinderpest, foot and mouth diseases, contagious pleuro-pneumonia or surra, and thereby enabling its officers to recognize them and to deal with them before the infection might get out of hand, and the Islands be swept clean of cattle, or the infection transmitted to the mainland. Most of these diseases do not require infected animals as carriers of the contagion, but clothes, utensils, food and various products may, under favorable circumstances, harbor the virus, or an intermediate host, as lice, flies, mosquitoes or rats may act as transmittors. It is therefore not impossible that either one of these destructive and highly contagious oriental diseases may appear here at any time even though no animals have been brought here from the Orient, and then will be the time when the Division of Animal Industry must prove its worth and value.

DISEASES OF LIVE STOCK IN GENERAL.

The past year has been practically devoid of any serious outbreak of either infectious or contagious diseases among live stock, while parasitic diseases have continued to decrease with improved methods in handling and caring for the animals.

GLANDERS.

Glanders among horse stock seems practically to have disappeared since the continued introduction of the infection with imported animals has been stopped by means of inspection, testing and quarantine. Here again, the *climatic conditions* undoubtedly have been of great value as there can be no doubt that many cases recover, temporarily at least, and some perhaps permanently. The total *absence of closed or ill ventilated stables* is the most important factor in the natural decrease of this scourge. Next to this the constant *vigilance of the deputy territorial veterinarians* who sooner or later are sure to locate even cases which are deliberately being hidden, in connection with the increased knowledge of the dangerous nature of the disease, have done much to cause either the destruction or at least the isolation, whether clandestine or not, of suspicious cases. To this must be added the *effect of the law enacted by the last legislature* making it a misdemeanor to sell or dispose of an animal affected with or suspected of having glanders and making the vendor responsible for any damages or loss resulting from such a transaction.



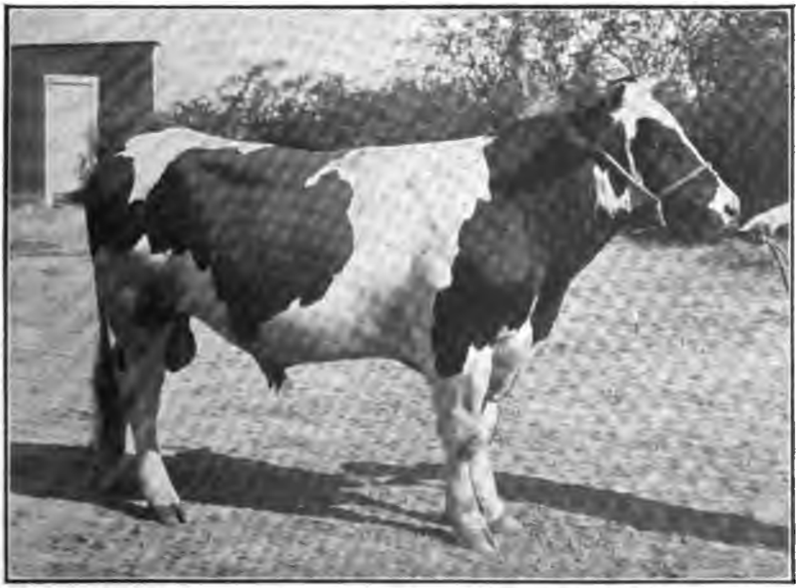


Plate 23. **Pure Bred Registered Holstein Bulls.**
Two and three years old. Introduced by the Parker Ranch.

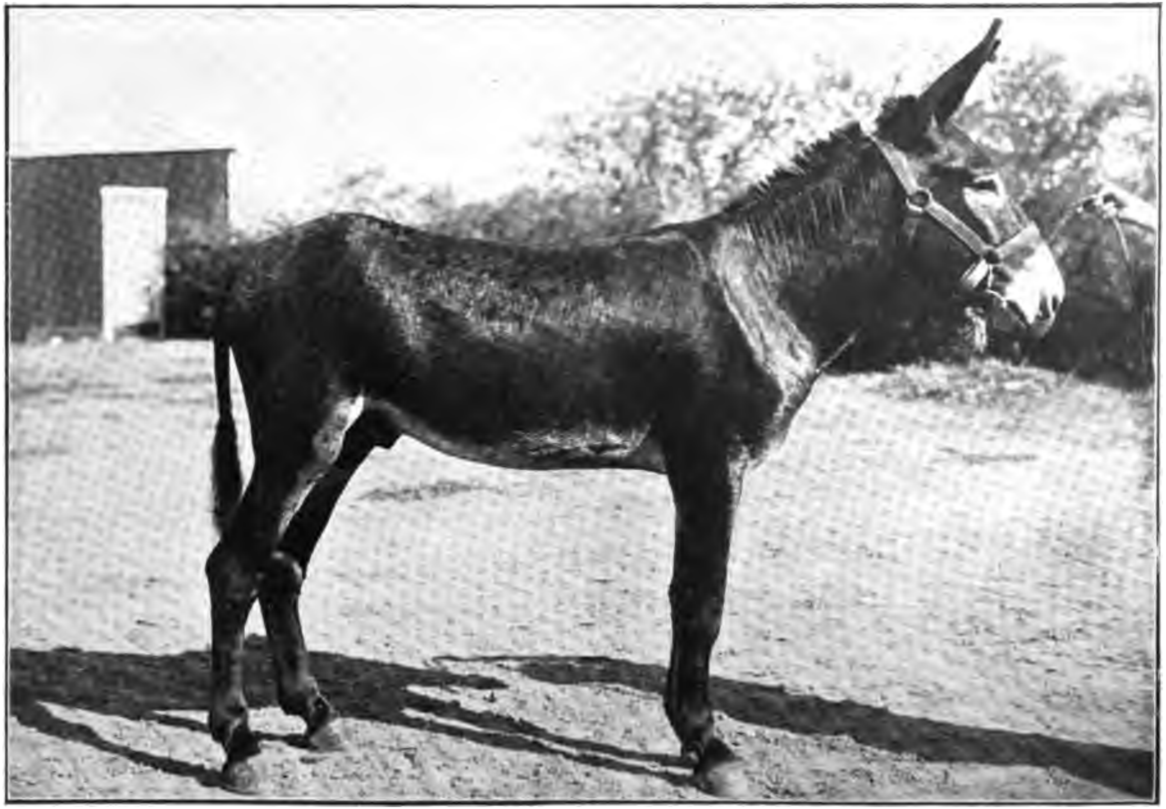


Plate 24. Kentucky Bred Jack.
Imported by the Parker Ranch.

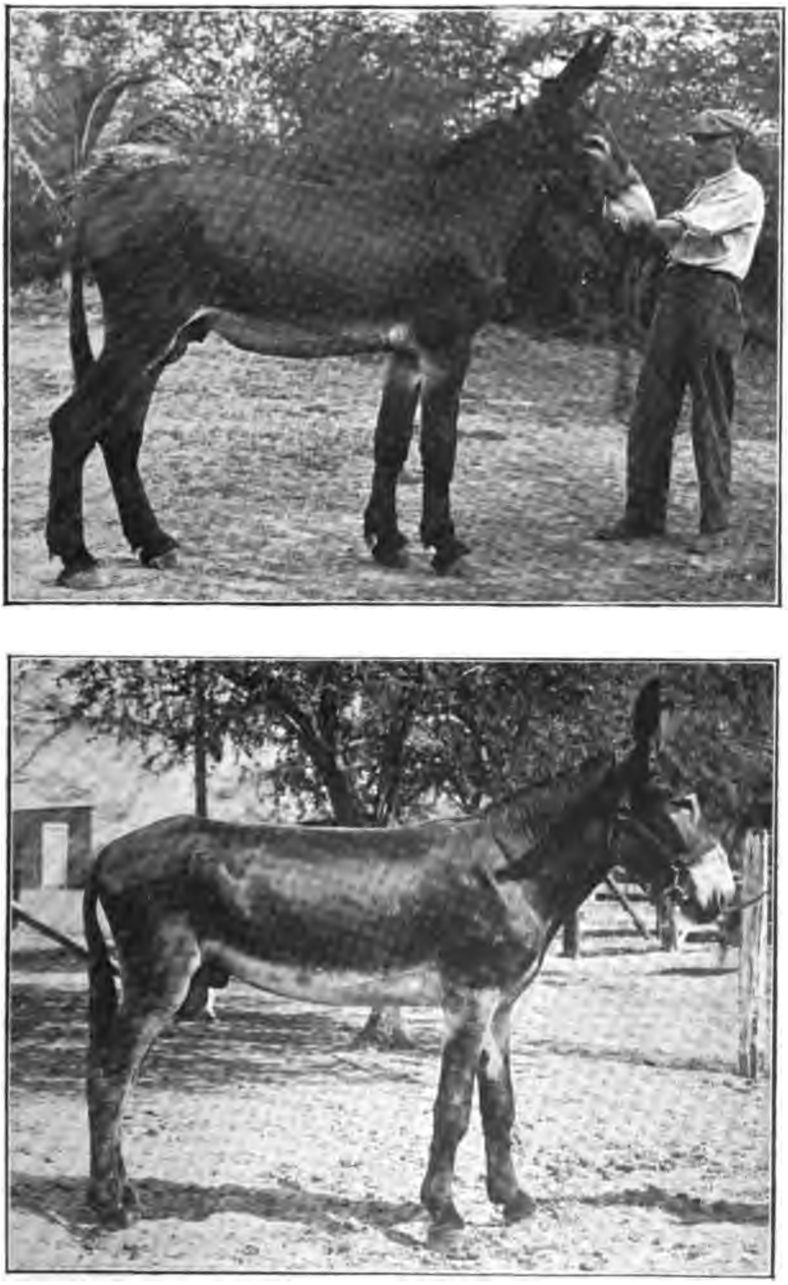


Plate 25. **Two Kentucky Bred Jacks.**
Imported by the Parker Ranch.

The immense *advance in the prices of horses and mules* has likewise had a tendency toward the prolongation of life of all work animals through increased efforts on the part of owners and employees in protecting them from exposure to infection, and not the least direct result thereof is the *elimination of the public watering trough* or the indiscriminate watering of horse stock at places where the nature of the supply is in the least doubtful. *The dissemination of knowledge* along these lines through the published reports of the Board has, possibly more than anything else, been responsible for this most remarkable decrease in a disease which in less favorably located countries, still remains at the head of the list of destructive diseases. But obviating further discussion as to which of these contributing factors is the most important, the fact remains *that glanders has practically disappeared* or else is effectively hiding itself, and it is safe to conclude that so long as the source of supply of fresh infection remains at zero, so long as no fresh cases of glanders are allowed to enter the Territory from without—and we continue to pay the price, eternal vigilance—so long will we remain free from the disease. On the other hand, let us relax and listen to the arguments of those whose source of income is at all depending upon the number of animals they sell, commensurate to a great extent with the number of animals which die, and whose chief argument is, that no case of glanders has arrived here from without for the past four years, and that consequently the regulations pertaining to importation are obsolete and no longer required,—and I feel confident that it would be but a very short time before we would have the disease with us again. The pass has been reached where the purchaser of live stock on the mainland has only to mention the fact that he comes from Hawaii when the *dishonest dealer disappears.* Let us rescind our regulations in the least, and the old conditions, when Hawaii—being 2,000 miles away—was considered the safest dumping ground for reacting horses and cattle, would speedily come to life again.

BOVINE TUBERCULOSIS.

What has been said above in regard to glanders among horse stock applies with almost equal force to tuberculosis of cattle. The climatic conditions, allowing of open stables the year around, are entirely in favor of the eradication of the disease. Many cases undoubtedly make a temporary or apparent recovery, and only a small percentage ever reach the fatal terminaiton, except when accompanied by advanced age. The regulations of the Board pertaining to the inspection and testing of cattle intended for importation, have effectively put an end to the further introduction of the disease from without. The eradication of the disease from the local herds has constituted the main work of this division for the past three years. A splendid spirit of coöperation, coupled with unexcelled willingness to sacrifice the affected animals, have characterized the campaign against the disease, making it possible to practically eradicate it from the City and County of Honolulu, without using either coercive measures or compensating the owners of diseased animals, even partly, for their losses. The same *educational measures,* the regular publication of monthly reports on the work of the division, has created a tendency on the part of milk consumers to demand clean milk, this is, milk originating on premises where no diseased (reacting) animals are kept, and where the milk is drawn and handled under sanitary conditions. In this work this division has had the full assistance of the local Board of Supervisors as well as the cooperation of the Honolulu Dairymen's Association. The former, through the office of the county physician, delegated its milk inspector to assist in the testing of more than 5,000 dairy animals, annually while the latter installed the most modern *electric milk purifying devices,* and what is most important, *refused to receive milk except from clean herds* and sanitary premises. A' the same time the local Board of Health, through its Pure Food Commissioner, coöperated by enforcing the requirements of the statutes pertaining to the official milk standards, with the result that the City of Honolulu may be said to have a milk supply second to none and equal to the best of any city of its size in the United States.

The adoption of the *intradermal method of tuberculin testing* has, so to speak, revolutionized the campaign of eradication of bovine tuberculosis, compelling, as it does, the confidence of the owners, and at the same time obviating the many inconveniences and objectionable features of the old subcutaneous method. The fact that an owner can see for himself whether an animal reacts or not, that he no longer has to blindly accept the word of the inspector—frequently in doubt himself as to whether the temparature record spells positive or negative—has by one stroke done away with ninety per cent. of the old objections to having the animal tested, and when a majority of the consumers demand of the producer to know whether the cows have been treated and whether any of the reactors are left on the premises before leaving an order for milk to be delivered at his home, then the moral effect becomes binding, and the result comes very close to one hundred per cent. of "clean" dairies, as is now the case in Honolulu. It is the aim of this division to extend the work of eradication of bovine tuberculosis to the entire group, and if the same spirit is found to prevail on the other Islands as on Oahu, the end is in view. With the assistance of the Deputy Territorial

Veterinarians on the other islands, who must be remunerated for the time given to the work, and with the necessary funds for traveling expenses for an inspector and an assistant sent out from this office, it is anticipated that a sufficient number of milk producers will be found willing to have their herds cleaned up, to compel the balance to either follow suit or go out of the business.

CEREBRO SPINAL MENINGITIS.

The only disease which has at all caused any alarm during the past year is *cerebro spinal meningitis* among horses and mules. Outbreaks of this have occurred on all four of the principal islands, but especially on Maui. In accordance with the latest views on the subject the disease must be classified as a *toxaemia,* due to the assimilation of musty or mouldy feed, rather than as an infectious disease. The condition cannot be transmitted from animal to animal, even by direct inoculation, and can always be controlled when it is possible to locate the existing cause, which is generally found to be musty grain or possibly water found to be contaminated by decomposing vegetable matter. A rather severe outbreak of this disease was investigated during the past year, and an attempt to stop it was made by applying Pasteur filters to the water pipes supplying the stables where the affected animals had contracted the disease. Owing to a considerable amount of sediment in the water the filters soon became clogged, and the experiment had to be abandoned. The principle, however, is no doubt correct and if the mechanical difficulties could be surmounted the disease could most likely be controlled or prevented by means of the filters. These would at the same time remove the eggs and embryos of intestinal parasites which, I am inclined to believe, always play a certain part where nervous symptoms appear endemically among horse stock.

The great prevalence of this disease in the States of Nebraska and Kansas during the past year, where more than 30,000 head of horse stock succumbed to it in less than three months, makes it a cause for congratulation that this Territory was spared any such losses, even though the disease was observed on these Islands [illegible]d is reported on by all the deputies on the other Islands. (See pp. 224, 234 and 245.)

SHEEP DISEASE ON LANAI.

Appended to this report will be found the correspondence pertaining to an outbreak of disease among the sheep on the Island of Lanai, where the assistant territorial veterinarian was then temporarily located. The deputy territorial veterinarian from Maui was also on the island, the two cooperating in an effort to reach some definite conclusion as to the nature of the epidemic which had carried off a great number of animals. From the description forwarded by the manager of the Lanai Ranch it appeared that, ever since another epidemic among the sheep was investigated during the latter part of preceding year, a report of which will be found in the annual report of this Division for 1910, the sheep had continued to die in greater or less numbers and at varying periods of intervals. Dr. Fitzgerald from Maui was first directed to investigate and report on the present outbreak, he being inclined to believe that the mortality was due to musty manienie grass, for which diagnosis there is ample support. The manager, however, leans toward a theory of an infectious disease, and even though I have been unable to find in the evidence submitted any reasonable grounds on which to base the diagnosis it was decided that so long as the sheep continued to die it would be better to make a bacteriological and microscopical examination, and with the consent of the President of the Board, Dr. Case was instructed to equip himself with a complete outfit for this work, Dr. Fitzgerald conducting the field work and Dr. Case the laboratory work. The results of this investigation will be found on page 214.

THE CONTROL AND ERADICATION OF BOVINE TUBERCULOSIS.

HUMAN AND BOVINE TUBERCULOSIS.

Ninth International Tuberculosis Congress.

Four years ago I had the honor to represent this Board as a delegate to the Ninth International Tuberculosis Congress, held at Washington, D. C.

As a result thereof I do not hesitate to say that the City and County of Honolulu is today practically free from bovine tuberculosis, and that the milk supply of Honolulu has been improved a hundred fold, and is today on a par with the best that is to be found anywhere. Thereby is not meant that it is perfect, far from it, as will be shown, but what in most places is considered as insurmountable obstacle, something to avoid or shirk or circumvent, that is, the eradication of tuberculosis from the dairy herds, has been accomplished in *one* of the counties of the Territory, and has demonstrated that the same can be done in the entire group.

The principal reason why I am taking this subject up at some length in this report is that two of my deputies, on Hawaii and Maui, are both of the opinion that tuberculosis has recently begun to spread at a much increased rate among the dairy herds in their respective districts, and further, that I have every reason to believe that had the work of eradication been delayed or deferred even one year longer here, we should have found conditions which it would have been impossible to tackle without extraordinary means and measures.

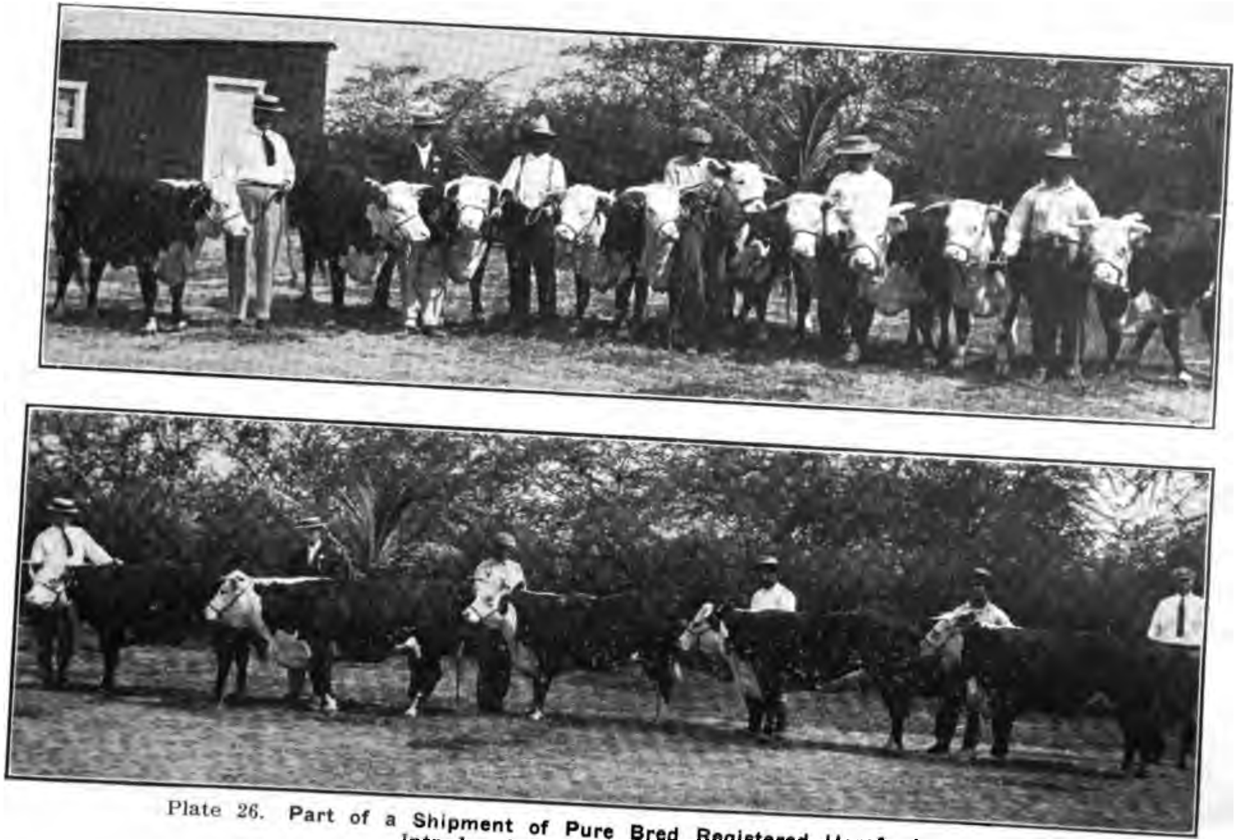


Plate 26. **Part of a Shipment of Pure Bred Registered Hereford Heifers. Introduced by the Parker Ranch.**

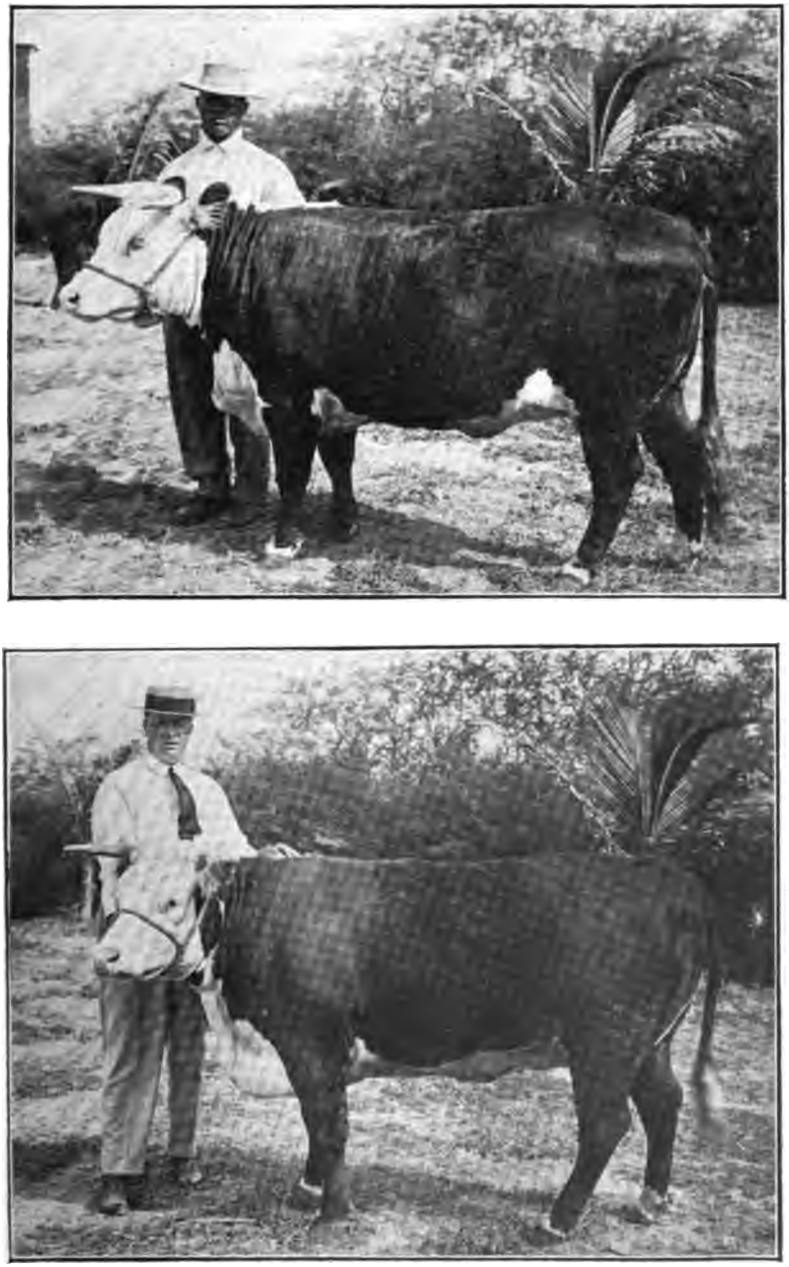


Plate 27. **Two Heifers by Bonnie Brae 8th.**
Perhaps the most famous sire in the United States.

There have been times during the past four years when I have been in doubt as to the advisability or the justice of the policy adhered to, that is, the absolute and uncompromising eradication of the disease, the toleration not even of a single reacting animal on premises where milk is produced for human consumption, but I am happy to say that, as the reports on similar work done in other States, Territories or foreign countries are received, it has become more and more certain that under conditions like those which obtain here there can be no procrastination, no dilatory methods—that if we were to conquer the disease here, it could be only by way of the slaughter house and not by any "Bang," "Ostertag" or "Birmingham" or any other method of eradication.

Tenth International Tuberculosis Congress.

The preliminary reports of the Tenth International Tuberculosis Congress, held at Rome this summer, have just come to hand.

As in the previous meeting, the most important question was of human and bovine tuberculosis in their relation to each other. Only Prof. Koch was not there any longer to defend his ultra-radical views on the subject and more definite conclusions were agreed on. Every civilized country in the world was represented, there being more than 3,000 attendants. One of the most interesting papers was by Prof. Calmette, who, among many other things, mentioned (1) that judging from their appearance under the microscope the human and the bovine type of the tubercle bacillus cannot be definitely differentiated; (2) culture methods do not distinguish them absolutely from each other; but (3) by inoculation into various kinds of animals, especially cattle, it can be proved more definitely which is which; (4) that the bovine bacillus is far more virulent or fatal to all mammals than the human form of the bacillus, except to the monkey, which is equally susceptible to both types; (5) that cattle cannot be infected, except locally, by inoculation with even very large doses of the human type; (6) that the bovine type, after sojourn for years in a human being, adapts itself to the appearance of the human type; (7) that in children who die from generalized tuberculosis, between the ages of 0 to 5 years, not less than 26.5 per cent show the presence of tubercle bacille of the bovine type; (8) that between the ages of 5 to 16 years the same percentage is 25; (9) that above this age the percentage falls rapidly, as low as to 1.5 per cent, but whether this is due to transformation from the bovine to the human type, or due to direct infection from human being to human being through cohabitation cannot often be determined; (10) that it is an undeniable fact that below 16 years nearly 75 per cent of all children dying from tuberculosis show the presence only of the human type and above that age the percentage of fatal cases due to the human bacillus is 98.36. From which it is clear that for the suppression of human tuberculosis we must first prevent its transmission from one human being to another, but at the same time prevent the infection of children wih the highly virulent bovine bacillus from the milk of tuberculous cattle.

Prof. Sims Woodhead of the Royal Tuberculosis Commission of England showed conclusively that about 20 per cent of tuberculosis in children was due to infection with the bovine bacillus; and Dr. Nathan Raw of Liverpool after confirming most of the above statements estimated that in Great Britain 15 per cent of all children who die from tuberculosis under the age of 12 years become infected with the bovine bacillus from milk. He proved by statistics that in countries where milk is boiled the amount of surgical tuberculosis in children (scrofulosis) is smaller, and h stated that with the vigorous inspection of dairy cattle the amount of surgical tuberculosis in children in Liverpool during the last ten years has, in his own hospital experience, been reduced by about 35 per cent. When we consider that this "vigorous inspection of dairy cattle in Liverpool" consists in the weeding out of "lungers" by physical examination, not by the tuberculine test, there is reason to believe that the percentage could be largely increased if our method were adopted.

However, the Italian Tuberculosis Congress clearly demonstrated, that the danger of bovine infection is now being widely recognized, the only difference of opinion now being as to the amount of such infection, and there can be little doubt that many countries will shortly adopt vigorous measures for its suppression.

Congress of the Royal Sanitary Institute of Great Britain.

In this connection I would mention the Congress of the Royal Sanitary Institute of Great Britain held at York, England, during the beginning of August this year. At this meeting Prof. Dewar of the University of Edinburgh made an address on the subject of the tuberculous cow and what to do with it, from which I shall quote a few sentences merely to illustrate *that what they are beginning to think about in England has been not alone thought about but carried into effect in this community, at least.*

Prof. Dewar starts by discussing the vastly improved conditions of animal life and the prevention of animal diseases during recent years, but recalls that these, though very desirable and beneficent in themselves, are nevertheless merely the means to an end. It is in the relation which these questions bear to the improvement of the health of the community and in their preservation of human life that they mainly derive their importance. The prevalence of tuberculosis among the herds in Great Britain is admitted and while the dangers rising from the use of meat and milk from tuberculous animals is acknowledged to be less than was at one time believed, few, if any, will dispute their existence *"and in the case of children and delicate or weakly individuals using raw milk the risk is a terribly real one."*

Regarding the inaction of the Government in connection therewith he says: "For more than twenty years now (since Aug. 12, 1889,) the supervision of the health of the live stock of the farm has been committed to the care of a special Government Department and although that department has looked quietly on while tuberculosis was killing not only its thousands, but its tens of thousands annually without so much as moving a finger to prevent the spread of the disease, that is no reason why the department should not begin to move at last and do something by way of honest endeavor for the protection and improvement of the health of the live stock of the country. Perhaps our profession is not altogether guiltless in that it has not done more to educate the public regarding the terribly serious nature and the extent of the disease. We ought to insist, in season and out of season, that something should be done, that some attempt should be made to arrest the progress of this terribl escourge."

That is what the Division of Animal Industry has done for five years past and that is why we stand today where we do, thanks to the unfailing approval and support of the Board.

Prof. Dewar goes on to say that on June 14th this year the Scottish Chamber of Agriculture held a conference at Perth, at which a resolution "was stated to have been unanimously passed," demanding Government compensation for the tuberculous dairy cow, i. e., that instead of merely ordering the cow out of the byre, she should be condemned to be slaughtered, and compensation paid for her. Whether this "demand" bore any fruits is not known but the fact remains that the idea was a good one, as has been demonstrated here. *To leave a tuberculous animal alive is simply to leave a center of infection, as isolation or segregation is an impossibility except in a government quarantine station.*

That we succeeded in exterminating nearly one thousand tuberculous animals without paying any compensation was due in a great measure to the education of the dairy men up to the point where they realized that the sooner they cleaned up their herds, the smaller the loss would be. Besides this we were fortunate enough to find in the Revised Statutes an old law which makes it a misdemeanor to sell or otherwise dispose of an animal known to be affected with a disease transmissible to man. As all reacting animals are branded immediately with an official registered brand, known to everybody, it is not easy to dispose of or even keep on the premises a tuberculous animal.

Prof. Dewar further states that tuberculosis in cattle, owing to its great prevalence, cannot be dealt with like other infectious diseases. It would not only upset the dairy industry, but the live stock industry and other collateral industries in interfering seriously with the country's food supply.

Pasteurization.

The same was claimed here and a milk famine was predicted when suddenly more than twenty per cent of the milch cows in the district were declared tuberculous. Pasteurization, however, came to the rescue and the milk famine vanished. That proved one of the greatest blessings for the general health of this community, as the necessity for pasteurization resulted in a reorganization of the Dairymen's Association and the installation of a modern electric milk purifying plant, which proved so absolutely satisfactory that even after all the tuberculous cows had been slaughtered, its use was continued, and at least 75 per cent of the milk consumed in Honolulu today is passed through it and reaches the consumer with less than 1000 bacteria per c. c.

In this connection it is worth mentioning that the Chief of the Federal Bureau of Animal Industry sounds an earnest warning against the use of un-Pasteurized milk, the same being based upon the fact that it has been definitely proven that the bacillus of infectious abortion is frequently found in commercial milk originating on farms where this disease occurs, not less than 11 per cent of all samples examined having been found contaminated with it. While it has not been definitely proven to be pathogenic to human beings, it is more than likely that it is, as it causes severe lesions in a variety of domestic and other animals.

When to this is added that the prolonged drouth which has prevailed here has been responsible for an unusual amount of dirt in the commercial milk in Honolulu and that the disease in question—infectious abortion—is known to exist here, then there is every reason for taking such precautions as may add to the safety of milk as a food, especially for children, and among these Pasteurization ranks as number one, whether the home or commercial variety.

The price of commercially Pasteurized milk in Honolulu has recently been raised to 12 cents per quart, but frequent bacteriological examination of this milk (see the appended report of the Assistant Territorial Veterinarian) as compared to the untreated commercial article has fully demonstrated the absolute safety of the product, which at the same time, due to the special process of

Pasteurization, has retained the taste, appearance, nutritive value and digestibility of fresh raw milk. It is, therefore, to be hoped that in some near future the entire milk supply of the city, at least, may be subjected to some process of purification similar to that now applied to the greater quantity consumed here.

But taken altogether the improvement in the local milk supply which has resulted directly from the eradication of tuberculosis from the herds,—not alone on account of the removal of the diseased animals, but to a very great extent also from the enforcement of the provisions of the Milk Ordinance incidental upon the repeated visits of the inspecting and testing officers (the city milk inspector always accompanies the testing inspector)—can hardly be conceived and must without doubt have contributed greatly to the general health of the community.

Reverting finally to the transmissability of bovine tuberculosis to human beings, and especially to children, and at the same time remembering the appalling prevalence of tuberculosis among the population here, and especially among the natives—more than twenty-five per cent of all cases of generalized tuberculosis among children under 16 years being due to the bovine type of tubercle bacilli, that is, tubrculosis introduced by milk from tuberculous cows, then *it appears indefensible to allow a single tuberculous animal to remain in the Islands since it has been demonstrated conclusively that the disease can be eradicated.*

In concluding this subject, the aim and object of which is the complete eradication of bovine tuberculosis from the Territory of Hawaii, a subject which has hitherto met with the unqualified approval and encouragement of the members of this Board, I beg to quote the last paragraph of Section V of the Recommendations of the Sanitary Commission (created under Act of the Legislature of 1911) and which reads:—

"Third—That a heavy fine be imposed upon any person convicted of selling milk from cows infected with tuberculosis.

"Finally, especial attention is called to the recommendations of the Milk Commission of 1910—that the control of milk be taken from the municipality and given to the Territorial Board of Agriculture in order to secure protection for the whole Territory —to insure an effective enforcement of regulations governing milk and its source of supply."

TUBERCULIN TESTING OF THE DAIRY HERDS IN THE CITY AND COUNTY OF HONOLULU.

Systematic work in ascertaining the extent to which the dairy herds of the City and County of Honolulu were affected with tuberculosis was begun during the middle of May, 1910, and embraces up to this date the tuberculin testing of every dairy on this island where commercial milk is produced, and also all the cows and breeding stock of the different ranches from which local dairymen obtain cows to replenish their dairies.

Up to the present time, three complete tests have been made which taken collectively give the following figures:

Total.	Cond.	Passed.	Suspicious
11,478	899	10,515	64

This gives an average percentage of 7.8% of tuberculous cattle on the Island of Oahu which have been eliminated from the dairy herds during the past three years.

That considerable improvement has taken place in the dairies, and that tuberculosis among them has decreased to a very appreciable extent is evidenced by the marked drop in the percentage of reacting animals during each succeeding year.

The first test comprised 70 dairies with a total of 1,955 animals of which 469 were condemned and branded; 1,434 passed and tagged and 52 regarded as suspicious, the percentage of reacting animals being 23.98%.

The second test comprised 137 daries with a total of 4,162 animals of which 226 were condemned and branded; 3,924 passed and tagged and 12 regarded as suspicious, the percentage of reacting animals being 5.8%.

The third test comprised 107 daries with a total of 5,361 animals of which 204 were condemned and branded; 5,157 passed and tagged giving a percentage of 3.8% of tuberculous animals.

It is interesting to note in this connection that in each test the higher percentage of tuberculous animals were found in the city dairies and that comparatively few diseased animals were met with in the country dairies and among range animals. The reason for this is that the close stabling necessary in the city dairies greatly facilitates the spread of the disease by keeping the various animals in immediate contact with each other over lengthened periods of time; the readiness with which a barn will become a source of infection through contamination with the excretions both from the mouth and alimentary canal, and the length of time such a place will remain a source of danger if not immediately and properly disinfected.

Taking only the city dairies into consideration and dealing with each as a unit not considering the number of infected animals in any one of them, we found on the first test out of 51 dairies visited, 16 to be free of disease while 35 were found to contain one or more reactors. On the second test, out of 78 dairies visited, 57 were found to be free from infection while 21 contained one or more reacting animals. The first test gave 31.4% clean dairies with 68.6% showing tuberculosis while the second test gave 73.1% clean dairies with 26.9% showing disease, which means that there was an increase of 41.7% of clean dairies in the City of Honolulu at the end of 1911.

On the third test, out of 77 dairies visited 60 were found free from infection and 17 were found to contain one or more reacting animals. This gives a percentage of 77.9% clean dairies and 22.1% still showing disease, unless the destruction of the reacting animals and the disinfecting of the premises have sufficed to completely eliminate the infection, which can hardly be expected.

Looking at the city dairies from the point of view of the number of animals, diseased or otherwise, and we find the following percentages:

	Total.	Cond.	Passed.	Percentage of disease
1st test..............	1404	439	922	31.26%
2nd test..............	1778	160	1618	8.9 %
3rd test..............	2056	111	1845	5.39%

Through the systematic work of tuberculin testing, tuberculosis has decreased in the dairies of the city 25.85% in the last three years, and from now on there will be a gradual decline of the disease until it is entirely stamped out. We have succeeded in eliminating all of the worst cases, that is, those animals which were rapidly disseminating the disease throughout the Island, and post-mortem examinations made on reacting animals should in the future disclose only a slight amount of disease. The remaining affected animals while showing no physical signs of disease, will intermittently disseminate the infection through every channel of elimination and, were the systematic testing to be stopped now, in the course of two or three years the percentage of tuberculous animals in the dairy herds throughout the Island would revert to what it was in the beginning; in other words time, labor and money would have been thrown away.

THE INTRADERMAL TUBERCULIN TEST.

During the past biennial period the intradermal test has been employed exclusively and has been found equally reliable and vastly more convenient than the subcutaneous test. It has therefore been somewhat of a surprise to us that only one State in the Union, Missouri, has employed it to any extent.

Without the aid of this test it would have been impossible for us to accomplish more than a fraction of the work done, with the means at our disposal, and the very fact that the test may be applied with equally good results to any animal, of whatever class, age and condition and under whatever circumstances and surroundings makes it in our opinion far more reliable than the older method, besides requiring only two visits to each animal, one for injection and one for examination.

In applying this test great care is necessary to see that the tuberculin is injected into the skin itself and not under it, in which case a subcutaneous injection occurs, which will vitiate all results.

We have found that an injection of four drops gives better and less confusing results than when the smaller dose (3 drops) as recommended by Moussu and Mantoux is given, the reason being that we have observed that there is liable to be a little loss from the amount injected due to the switching movements of the tail pressing it out.

Ward and Baker in their experiments with the intradermal tuberculin test used a specially prepared tuberculin put up by the Cutter Laboratory, and which was a ten per cent. solution of the crude tuberculin. The dose they used was the same as given in the original investigations of Moussu and Mantoux.

In the first part of our experiments we also used the Cutter Laboratory preparations, but later we found that just as accurate results could be obtained from using B. A. I. tuberculin reduced by evaporation to one-third of its volume. This tuberculin being furnished free of charge to those States and Territories engaged in official work, the cost to the Territory of carrying out this portion of the stipulations of the milk ordinance, was materially reduced.

CHARACTER OF REACTION.

In this test a reaction consists of a swelling of variable size at the point of inoculation. Some reactions are well circumscribed and vary in size from a kidney bean to an English walnut, others are diffuse in character, the entire fold being thickened to three times its normal dimensions. The swellings are firm and resistant to the touch though not hard, and are of an inflammatory nature though seldom hot and, with the exception of a few cases, little or no sensitiveness. Contrary to Moussu and Mantoux we have found seventy-two hours the safest time to allow to elapse before examination.

Without doubt the majority of tuberculous animals can be picked out at the end of forty-eight hours but, there will be, in some instances, a few which will not show the characteristic reaction until a later time, which makes it advisable, if only one examination can be made, to wait seventy-two hours. By doing so nothing is lost and everything gained, as the swelling remains five or six days.

The substitution of the intradermal for the subcutaneous test has been very beneficial in many ways, but most of all in simplifying the procedure by reducing the required number of visits from eight or ten to two, and in obviating the necessity of keeping the animals confined at all, the injection, examination and marking being performed while the animals are kept in at milking time.

Range stock is tested simply by confining them in a chute during the act of injection, examination and marking. The excitement incident to driving and the resulting high temperatures of the animals make no difference whatever.

On the subcutaneous test 469 animals were condemned and branded. By the time the second test was started only twenty-nine of these condemned animals remained available as checks on the accuracy of the intradermal test, the others having been disposed of through the different slaughter houses. It may be stated at this point that post-mortem examination of these 440 slaughtered animals demonstrated in every case, the accuracy of the subcutaneous method as all were found diseased in some part or other of the body.

The remaining twenty-nine condemned animals were scattered over the island in the different dairies, some having changed hands several times, and were subjected to the intradermal test as they were found. This was done solely to establish the accuracy of the new test and not with the idea of passing the animal should it fail to show a reaction, as it is the firm policy of this Division to regard an animal which has once reacted, as diseased for all time whether or not it may show a subsequent reaction. This policy is, however, approved of by all the foremost scientific investigators of the present day.

Only two of the twenty-nine animals failed to show a reaction to the intradermal test, the remaining twenty-seven all giving typical reactions which remained in evidence from five to six days. Of the two cases which failed to show a reaction the one was an advanced case of generalized tuberculosis; in the other the disease was confined to small incapsulated nodules in the retropharyngeal and bronchial lymph glands were all in a more or less calcified condition, all of which tended to show that the disease had reached a quiescent period. That the intradermal test failed to reveal the presence of tuberculosis under these circumstances is not strange as under like conditions the subcutaneous test quite frequently fails to disclose its presence.

Taking this into consideration and also the fact that no animal passed as clean by the old method and similarly passed by the new method has been proven to be diseased upon post-mortem examination, and the further fact that several animals which were passed as clean by the old method gave distinct and typical reactions by the new method, post-mortem examination proving the presence of the disease, there is every reason to conclude that the new test shows a very high degree of accuracy and that its substitution for the old method is fully warranted.

DISINFECTION OF PREMISES.

The importance of disinfection in the control and eradication of an infectious or contagious disease cannot be overestimated. Especially is this true in dealing with tuberculosis, the causative organism of which is not only protected by waxy substances in its make up but is also protected by the mucous secretions of the patient eliminating them.

The careful testing of a herd, the segregation and ultimate disposal of all reacting animals is of little value if not followed immediately by an equally careful and thorough disinfection of the premises. Since the manure of tuberculous cattle often contains living tubercle germs in vast numbers, the importance of keeping it well cleaned out of the stable is readily seen. Such manure is not only dangerous to the other cattle in the stable, but may be the means of conveying the disease to human beings through contamination of the milk while being drawn.

The following methods of disinfecting stables after they have first been thoroughly cleaned, washed and aired are in successful use:

(a) Spraying the walls, stanchions and feed boxes with a solution of corrosive sublimate in the proportion of 1 part of corrosive sublimate to 500 parts of water.

(b) Spraying the walls, stanchions and feed boxes with a solution of carbolic acid in the proportion of 5 parts carbolic acid to 100 parts of water.

(c) Washing the walls, stanchions and feed boxes with whitewash to which chloro-naptholeum has been added in the proportion of 1 gallon of chloro-naptholeum to the barrel.

The method of disinfecting is not of as much importance as the thoroughness and frequency of its application. Any one of the three methods above mentioned will bring about the desired results, but with the last named there is a check on the thoroughness of its application, as any place overlooked immediately shows up. It also has the advantage of being non-poisonous. Whitewash prepared in this way not only acts as a disinfectant but seems to be greatly improved in its sticking qualities, not flaking off so rapidly. It may be applied either with a spray-pump or with a brush. The whitewashing should be done at least once a month until the herd has been proved free from infection by the next general test.

CONCLUSIONS.

(1) That the intradermal method of testing is the only practical way of controlling and eradicating bovine tuberculosis, the cost of any other method being prohibitive.

(2) That the intradermal method is fully as accurate in its results as the subcutaneous, and far more saving in time, labor and money.

(3) That tuberculosis among the dairy herds of the City and County of Honolulu has been reduced to a minimum, and the next few years will see its complete eradication from the Island of Oahu, especially if reimbursement for reactors is decided upon.

(4) That the success or failure of our work against this fatal disease, this fundamental source of infection to the human race, will depend entirely on the support or non-support given the Board of Agriculture and Forestry by the public.

THE MILK SUPPLY OF THE CITY AND COUNTY OF HONOLULU.

Milk is produced in one hundred and seven (107) dairies scattered over the Island containing, according to records of the last tuberculin test, 5,361 animals. Of this number 77 are city dairies with a total of 2,056 animals, and 30 are country dairies with a constantly changing number of animals.

During the past two years considerable improvement has taken place in the sanitary conditions of the dairies throughout the City and County. Many improvements have been made in the construction of shelter and stables; cement floors and proper drainage; building of milk rooms and installation of satisfactory cooling devices where ice is used if obtainable, and if not, the milk is cooled to the temperature of the available water supply. A number of new barns have been constructed on up to date sanitary lines and suitable to this climate.

All this has taken time, patience and a good deal of perserverance, and does great credit to the County Milk Inspector who has been assiduous in his duties, and who has been given all possible advice, which has been intelligently followed out. The enforcement of the local milk ordinance has been of untold benefit to the community, especially as milk is not allowed to be drawn or in any way disposed of for human consumption from cows known to be affected with tuberculosis, such animals being immediately removed from the dairy or adjoining premises and disposed of through the slaughter house, under competent inspection.

In general there is little disease of any kind among the dairy stock of the island. As a rule they are well fed and well taken care of, though the high cost of feed prevents the development of milk production in the young stock, most of which are raised on the range.

However, improvement is slowly taking place in the class of animals found in the different dairies, there being increasing numbers of importations of high class dairy stock which in time is bound to make itself felt both as to quantity and quality of the milk produced.

In general, greater care is being exercised in the production of the milk than hitherto. The milk is being strained through several layers of cheese cloth and run over a cooler before being sealed in containers; more attention is being paid to the grooming of the cow at the time of milking, and also to the cleanliness of the milkers.

Nearly all milk producers have constructed on their premises more or less complete milk rooms where the milk is taken when drawn and where it is strained, cooled by ice or running water and bottled or put into cans. This has been a great step forward in the sanitary production of milk, but still much remains to be done. Greater care should be exercised in drawnig the milk; cleaner barns and cleaner cows, properly confined during milking time should be insisted upon; the keeping out to a greater extent than at present of dust and flies from the milk rooms; greater care to be used in cleaning milking utensils, and especially that proper cooling of the milk be insisted upon. Cooling without ice, in a semi-tropical climate, must of necessity remain a farce. To establish a standard temperature of 77° F. as the point to which milk must be cooled and kept "until removed for delivery thereof" is entirely inadequate to prevent the rapid multiplication of bacteria, which is bound to commence from the moment the milk leaves the udder unless infection or contamination is prevented by the most rigid sanitary or hygienic methods, and as these measures are not provided for by the milk ordinance, cooling would seem to have been the one measure that should have been insisted upon.

THE BACTERIOLOGICAL EXAMINATION OF THE MILK SUPPLY

One of the most important points connected with the production of clean milk is the bacteriological examination at stated intervals of the product as it comes from the different dairies. From these examinations reliable data can be obtained regarding the sanitary condition of the dairy and the care used in handling the milk. Bacteriological examinations are a check on whether or not the rules and regulations of a milk ordinance are being properly enforced, and carried out. Neglect of any part of the utine in milk production results in a high bacterial count.

During the past two years many bacterial counts have been made of milk samples taken under varying conditions, and the results in many cases have been far from satisfactory. While the majority have been within the limits set by the milk ordinance—which by the way is ten times greater than it should be—a few have exceeded this limit two and three times. The counts run all the way from 30,000 to 3,000,000, the average being in the neighborhood of 750,000 to 800,000 bacteria per cubic centimeter.

That such high counts should be possible shows that something is radically wrong in the handling of the milk; either the product is contaminated while being drawn from the cow, or else when it is being cooled and put into containers; it is probably a combination of the two.

The opportunities for contamination are many and the overlooking of a single point will result in the production of an inferior article. To obtain a clean product clean methods must be employed. Of what benefit is it to milk through a small opening into a sterile pail if the milker has not cleaned his hands, and the flanks and udder of the cow are dirty, the floor a foot deep with manure and the animal switching its tail continually?

Taking it for granted that the milk is drawn under ideal conditions, i. e., clean stable; clean animal with tail confined; milker with clean hands and suit, with a properly constructed pail, the milk will become contaminated and show a high bacterial count if poured over a cooler which is exposed to the dust and dirt, which may blow into the milk room from the street or barn-yard, and then put into improperly cleaned bottles and cans.

These are points to be closely watched by the Milk Inspector in his daily round of inspection. Milk can and should be produced here with a count of 100,000 bacteria per cubic centimeter or less and nothing over that amount should be allowed. There is at least one dairy in this City which is producing a high quality milk with a count which has never gone above 50,000 bacteria per c. c. and if this can be done in one dairy it can be done in all. This should be the aim and object of the Milk Inspection Service.

MILK PURIFYING BY ELECTRICITY.

In Honolulu there has recently been erected, by private enterprise, one of the most complete milk purifying plants to be found anywhere in the United States. Here the milk is brought from many dairies and subjected to the following process:

The milk is first filtered through double layers of cheese-cloth and absorbent cotton into a large tank where it is kept in constant motion, so as not to allow the cream to rise, and from which it is pumped through pipes to the electrical purifying apparatus, being subjected on the way to a steam temperature, which can be regulated to any desired degree.

Upon reaching this point it passes through a series of aluminum plates and is subjected to an electric charge, which is supposed to kill all bacteria present in the milk. During this process the temperature is increased and will register a high or low temperature proportionate to the temperature of the milk as it reaches the purifier. It is so regulated that the milk is subjeced to a steam temperature of about 150° F. and an electrical temperature of about 164° F.

After passing through the purifier it is allowed to fall upon a series of pipes containing running water, ice water and brine, in the order named, which cools it almost instantly to a temperature of 40° F. The milk is kept at this temperature until delivery, and then delivered packed in ice. The whole process from the time it starts from the first tank to the time it reaches the second tank from which it is bottled, takes less than a minute.

This is the ideal purifying plant, and the ideal way of furnishing to a city mechanically purified milk. Repeated bacteriological examinations of milk as it entered the plant and again after purification and cooling have proven in every instance the high efficiency of this method of treatment. Milk going in showing counts ranging from 500,000 to more than a million bacteria per c. c. come out with the reduced count of from 500 to a thousand organisms per cubic centimeter. In spite of the efficiency of this plant is it not the wish of the Dairymen's Association to secure milk from tuberculous herds or from dairies in a filthy and unsanitary condition. The position occupied by the Dairymen's Association and its plant in the system of milk supply of the City is such as enables it to exert a powerful influence toward the betterment of the product as it reaches them, and it should use this influence to encourage its many contributors to produce clean milk or else refuse to accept it.

GLANDERS IN THE TERRITORY.

As already stated in the Letter of Submittal, as well as in the introduction to the chapter on Diseases of Live Stock, only one outbreak of glanders of any importance has occurred in the Territory for the past two years, this being the epidemic in Waipio Valley on the Island of Hawaii, and which it is fully believed has been completely suppressed. As this is the largest outbreak which has ever occurred here it is described in full on the following pages.

Besides this there have occurred 2 isolated cases of glanders and two of epizootic lymphangitis, all of which by prompt action remained confined to single animals. One of the latter cases, however, appeared under such peculiar conditions and might have had such serious consequences that it is deemed of interest to report it here in full as an illustration of the effectiveness of energetic measures when promptly and conscientiously carried out.

GLANDERS AT SCHOFIELD BARRACKS.

On October 5th, 1911, we received a letter from Dr. Vans Agnew, veterinarian to the 5th U. S. Cavalry, Schofield Barracks, informing us that one of the horses in Troop A was suffering from a nose disease which, though far from being characteristic of glanders, still was accompanied by lesions and symptoms sufficiently grave to warrant caution, and requesting us when convenient to come to Leilehua and make an examination of the animal.

The animal was found to suffer from ulcerations of the mucous membrane in both nasal chambers with considerable sticky discharge from both nostrils, which discharge, at intervals, was mixed with blood to the extent of constituting a hemorrhage or epistaxis. There was, however, no swelling of the submaxillary glands and, as the animal had been under treatment for warts and tumors in the nose for several months past, it did not seem likely that the case was one of glanders unless as a secondary and very recent infection. The fact that the ulcerations were not located on the septum (the partition between the nasal chambers) in connection with the extremely swollen condition of the mucous membrane immediately surrounding the ulcers likewise pointed to a negative diagnosis as far as glanders was concerned, but pointed on the other hand equally certain to epizootic lymphangitis, a disease which in these Islands has proved itself far more dangerous and much more difficult of eradication than glanders. It may be mentioned that in two outbreaks of this disease, both on the Island of Maui, though widely separated, not less than $3,000.00 worth of horse stock had to be sacrificed or died within a week or ten days, in each case. We did therefore feel a great deal more apprehension than had the case proved to be glanders. However, in order to eliminate the question of glanders entirely the animal was subjected to the mallein test, to which it gave not the slightest reaction, thereby practically confirming the other diagnosis.

It may not be out of the way here to explain why this case is described under the heading of "Glanders," when, in fact, the animal was suffering from a specific infectious disease, not even caused by a bacillus, like glanders (bacillus malleus), but by a fungus (saccharomyces farciminosus); only, that the nature, symptoms, course and termination of the two diseases, the latter almost invariably fatal after a most violent course, extending, as a rule, over only a few days, and as the accepted postulates of veterinary jurisprudence are identical for the two diseases in those countries where both occur with equal virulence, it has been considered neither advisable nor desirable to promulgate special rules and regulations for a disease which for centuries has been considered as, or classified with, glanders or farcy, and which is not even possessed of a name comprehensible to a layman.

When, consequently, the diagnosis of epizootic lymphangitis had been accepted, the situation became as stated very grave. The affected animal, which was rapidly getting worse, had belonged to Troop A which only a few days before had been disbanded and the individual mounts distributed among the eleven other troops of the regiment. If, therefore, any of the contacts, that is, animals which had been more or less exposed to the infection from contact, had become infected there was a likelihood of everyone of the remaining troops developing the disease in varying numbers of cases, and when to this is added that the entire regiment had left the reservation for a practice tour around the island it will be seen that there was sufficient cause for apprehension, not to say alarm. When, therefore, the following day the regiment arrived at Fort Shafter we immediately called on Dr. Vans Agnew and laid the facts before him, suggesting the inspection of all the animals without delay. This, however, did not prove necessary as the doctor had been with the regiment all the time and every case of sickness was known to him and so far none had shown any suspicious symptoms. That was encouraging so far, as the hardships of the tour undoubtedly would have caused the early appearance of symptoms had any of the animals become infected. The doctor was, however, positive that there was no discharge from the nose of any of the mounts or draft animals and the conclusion seemed justified that no infection could have been scattered by the regiment even if some cases might develop later on.

It was nevertheless decided to submit the matter to the commanding officer without delay and as the possible contacts were scattered through all the troops he was easily persuaded that no halfway measures would be of any avail. With his sanction of a thorough disinfection of all of the stables at Schofield Barracks we applied to the Board of Health for the loan of a portable steam disinfection plant, which, the following morning, was placed on board a train and shipped to Leilehua.

In this connection I wish to state that the Board of Health represented by Mr. Charlock, acting president, and Mr. Kirk Porter, secretary, did everything possible to assist in eradicating this infection which threatened the decimation of the cavalry and artillery horses stationed here. Not alone did they supply the engine with hundreds of feet of hose, but they advanced the requisite disinfecting material (corrosive sublimate and hydro-chloric acid), and for two days Mr. Charlock, with an engineer and an assistant, supervised and directed the work, giving their time as well as experience in handling as extensive an undertaking as the disinfecting of 1,200 stalls.

A force of privates was put to work removing all straw, bedding and feed from mangers, racks and stalls, all of which was carted away and destroyed by burning, after which the hose gang saturated all woodwork and floors with the strong disinfectant. After this had been allowed to soak in, the surplus liquid was washed away with clean water in the same manner as the disinfectant had been applied, and it is a matter of record that not a single case of poisoning was reported after the animals had been returned to the stalls. All watering troughs were emptied, cleaned and disinfected and the fact that only one suspicious case has been reported since is ample proof of the thoroughness of the work.

When the regiment returned to Leilehua shortly after noon on October 13th everything was ready for the animals, but as a further precaution every horse and mule was inspected before being allowed to go to its stall.

The following day another suspicious case was reported but was discharged two weeks later, having failed to develop symptoms indicative of either glanders or epizootic lymphangitis.

GLANDERS IN WAIPIO VALLEY.

On October 30, 1912, a wireless message was received from the Manager of the Kukuihaele Plantation, Hamakua, Hawaii, stating that an epidemic had broken out among the horses and mules in Waipio Valley and requesting that the Territorial Veterinarian be notified, which was done immediately. Glanders was suspected at once, but as the message seemed to indicate that the recent heavy rains in the district might be a contributing cause, and as the death of seven horses within a short period pointed to some acute infectious disease, such as epizootic laryngitis, the glanders theory seemed doubtful, even though the seriousness of the situation was realized.

Waipio Valley or Gulch is an absolutely isolated district approachable only by way of a rough, steep trail, descending a thousand feet or more at an angle of 40 to 45 degrees from a point a short distance north of the village of Kukuihaele, where the plantation stables, with more than 250 head of mules and horses, are located. The transmission of the infection to the plantation animals was therefore imminent, and the same applies to the adjoining string of plantations, stretching south along the east coast of Hawaii, as well as to the Parker Ranch, all of which are visited regularly, twice a week, by pack trains from Waipio Valley carrying rice and paiai.

In order to understand all points in connection with the present outbreak it is necessary to recall an epidemic of glanders which occurred in Waipio Valley in 1907, and which is fully described in the annual report of this Division for said year (pp. 129-134).

The fact that more than five years had elapsed, without another case being reported, had naturally led to the conclusion, that the measures taken in 1907 to eradicate the disease had been successful; but subsequent developments demonstrated fully that such was not the case, that the suspicions to the effect that all exposed or diseased animals had *not* been presented for examination, were fully justified, and that the oriental horse owners had benefited by mine and my assistant's previous visits only to learn how to conceal the presence of the disease, and *not* how to conquer it. That the disease, during these five years, has not gained entrance into the Kukuihaele plantation stables, located less than a mile and a half from the heavily infected paddock in Waipio Valley, and in fact, that the disease seems to have been confined practicalley to the stables and paddocks of the same Chinese rice planter who suffered such heavy loss from it in 1907, speaks highly for the intelligent efforts which must have been put forth to prevent the spread of the disease, even while it continued to ravage his own stables. If the same vigilance should have been continued the present conditions might have remained unchanged for an indefinite period. Mr· Akaka, the rice planter in question, continuing to suffer his losses in silence, but at the same time taking every precaution possible to prevent other animals than his own to become infected. It happened, however, that Mr. Ahrens, the Manager of Kukuihaele Plantation, saw a bunch of twelve young pack mules, which Mr. Akaka had purchased from the Parker Ranch some three months ago, when they were taken through the village down to Waipio Valley, to take the place of some of those which had succumbed to the disease. Subsequently Mr. Ahrens noted that Akaka's pack trains, when passing through the village, contained fewer and fewer of these young mules; but it was not until a few days ago, when only one or two mules appeared in the train, that he inquired of the man in charge, what was the matter, and learned that all of the rest had died. On the basis of this information he cabled his agents here, as above mentioned, and fearing something more dangerous to his own animals, as may be easily understood.

Having received instructions from the President of the Board, I left for Kukuihaele on October 30, 1912, arriving there at ten o'clock the following morning, and proceeded immediately to

Waipio Valley accompanied by the local agent of the Territorial Board of Health, Mr. Renfrew, who throughout the investigation was of inestimable value and assistance to me. Mr. Renfrew had isolated all of the apparently serious or dangerous cases, and that his judgment was sound was proved by the fact that every one of these animals, seven in all, were subsequently killed.

The first day in the Valley was exceedingly disagreeable, a constant pouring rain necessitating the continuous use of oil skins and making the trail dangerous. Several times my horse slipped and nearly sent me headlong over the pali. However, we reached the bottom safely, but the mud and rain made the work slow and exceedingly disagreeable. After inspecting the isolated cases, the rest of the animals belonging to Akaka were examined, and several had to be pronounced suspicious. The symptoms of the isolated cases were swollen submaxillary glands, a more or less profuse discharge from one or both nostrils, the character of the same being either watery (glassy) or darker colored, but in all cases forming thickly greyish-brown crusts around the nostrils. In three cases distinct blebs and old cicatrices could be seen on the septum (the partition dividing the nasal cavity), but in only one case were actual ulcerations observed. In connection with this, all the animals, both the isolated, suspicious and most of the balance, there being 34 in all, showed more or less pronounced symptoms of osteoporosis (big head), the facial bones as well as the brances of the lower jaw being swollen to nearly twice their natural size. The backs were humped, the ribs flat, the bones of the extremities generally enlarged, and what with the staring, stupid eyes in the drooping coffin-like heads, the parchment-like skin bedecked with either sores or scars from pack saddles and straps, the animals made indeed a very sorry appearance and presented a combination of symptoms easily misjudged by the unwary or inexperienced diagnostician. To this must be added the great prevalence of the Hawaiian nose disease (described in my earlier report), the presence of which is very likely to obscure and even make the diagnosis of glanders impossible to the experienced veterinarian, without the aid of mallein. Of this material I was unfortunately not provided with a sufficient quantity to make a thorough investigation at the time, as, owing to the practical eradication of glanders everywhere in the Islands, except in this place, it had not been considered necessary to keep on hand more than a dozen or two doses. Mallein deteriorates with age, and cannot be kept in stock in quantities of 150 to 200 doses—the amount which will be required here—except at considerable cost.

During the following days an attempt was made to inspect all the horses, mules and donkeys in Waipio Valley, and it is believed that all the animals were seen. In rounding up both owners and animals, the Hamakua police lent valuable aid, supporting the Board of Health inspector and his assistants in securing a complete list of names of the owners and the number of animals belonging to each. A paper slip bearing my initials was attached with poi to each animal after examination, and owners who had failed to bring all their animals were promptly returned for the missing ones, whatever the excuse might be. Notes were taken in regard to such animals as it was deemed advisable to see again, even though most of the suspicious cases were recognized as Hawaiian Nose Disease. All such animals, however, should be tested.

On the first visit to the Valley permission had been granted to the consolidated paiai manufacturers, as well as to Akaka, to bring their animals, loaded, to the mouth of the valley, their further progress depending on their condition at the time of arrival at the end of the climb. At 7:00 a. m. Friday morning, the paiai train arrived and the animals were passed through the barrier placed across the trail, one by one. They were all passed—forty-one head—and allowed to proceed to their destinations with their loads. Shortly afterwards Akaka's train arrived, twelve horses carrying twenty-four (24) bags of rice. These animals were the best he could pick from those not segregated, but they all arrived in bad condition with staring eyes and blowing hard—every one running from the nose. They were ordered to discharge their packs at the spot, after which they were returned to the Valley and segregated without delay. One of these animals, at least, showed traces of blood in the otherwise clear discharge. As a stampede might have proven disastrous, no attempt at a careful examination was made, the animals not taking kindly to handling by strangers.

Later in the day they were examined again, together with the segregated ones, and while no ulcers would be perceived in the nose, several showed traces of blood in the discharge and had the glands considerably enlarged. They must therefore be classified as suspicious.

On Saturday the segregated animals were re-examined and, as was expected, the discharge had become less profuse as a result of the dry, warm weather, allowing of an easier interpretation of the symptoms. Every one of these seven animals were showing typical ulcerations and stellate scars on the nasal septum, which in connection with the hard, swollen glands under the jaw and the characteristic gluey discharge confirmed the diagnosis of *glanders*. The animals were, therefore, ordered sent to the beach where I shot them in such positions as to leave the bodies below the high tide line, which, the natives assured me, would cause the carcasses to be carried to sea by the receding tide.

A strange sight was presented at this place, seldom visited by anybody except for the purpose of disposing of dead or dying animals. Here bones and skulls were littering the beach, many of them still retaining traces of flesh and ligaments, indicating that they had but recently died. Four white bleached skulls were found having bullet holes in the forehead, evidently the remains of those which were killed at this place five years ago. In several cases the skulls and neck vertebrates were found tied with a rope to a large rock, without indication of injury to the skull either by bullet or axe, showing clearly that the sick or dying animals had been taken to the place and left to die without the mercy of a death blow. Considering that a majority of the bones and carcasses must have been carried to sea, the number of those remaining in sight were a sure indication of a very high mortality among the horse stock of the Valley, which has never been known to exceed 200 head.

Before leaving Honolulu a wireless message had been sent to Mr. Ahrens, directing him to place a reliable man at the mouth of the Valley in order to detain and segregate any sick or suspicious animals which might attempt to leave the Valley. Mr. Ahrens invoked the assistance of the police as well as the local agent of the Board of Health, as a result of which the above mentioned seven horses were on hand for examination. Notice had also been sent to the Parker Ranch as well as to the other plantations visited by the pack trains from Waipio to guard against the possible transmission of the disease through watering troughs, hitching posts, mangers, etc. Similarly the Japanese stage lines as well as the Volcano Stables Transportation Company were warned to be on their guard.

To establish an absolute quarantine against all horse stock in the Valley would cause a severe hardship as it would practically put to a stop the only existing industries there, rice and poi, besides causing at least a temporary famine for these products in the entire Hamakua district. The destruction of the seven visibly affected animals cannot be said in any way to have eradicated the disease but can be regarded only as a temporary measure or check on its further spread for the present. There can be no doubt that a number, if not all, of the remaining twenty-seven (27) head of horses in Akaka's stables must be infected and will develop the disease sooner or later, especially when it is remembered that eleven head of mules developed the disease and died within the last two or three months, all of which have been in more or less frequent contact with the surviving animals.

As an absolute quarantine on all of Akaka's animals would have put him entirely out of business, he having already suffered severe losses, it was decided to allow him to use the apparently sound animals to carry rice up the pali to the mouth of the Valley, but no further. It was impressed upon him that the responsibility would fall on him in case the disease should appear outside of the Valley, and he promised solemnly to take every precaution and to carry out the instructions to the letter, to guard against its further spread. In a similar way all the other horse owners in Waipio were warned against having their animals come in contact with Akaka's, most of them declaring they had already established such measures for their own protection. Akaka was further warned against selling or disposing of any of the horses now in his possession, the law covering the subject being called to his attention and all of his animals declared to be suspicious until otherwise proved. The local police as well as the Board of Health agent were given full instructions to the same effect. and will continue to co-operate with the Board until the disease is eradicated.

With the enforcement of these measures it is believed that every possible precaution, under the circumstances, has been taken, and with the experience of the past five years before us, it may be assumed that the danger of the disease spreading beyond the Valley is but small if prompt action is taken to eradicate it completely· The complete eradication, however, is a matter which will be insisted upon by all the stock owners and breeders in that neighborhood and especially by the plantation located immediately at the mouth of the Valley. That they are entitled to such protection cannot be disputed so long as they have gone to great expense in eradicating the disease from their own premises and even building new and modern stables for the housing of more than fifty thousand dollars worth of work animals. Every one of these 250 animals were carefully inspected and were found to be in excellent health and condition.

I would therefore recommend that the Board direct me to return to Kukuihaele in order to make a thorough investigation of the entire northern Hamakua district, from Kukuihaele to Kohala, that is the rounding up of all horse stock in Waipio Valley, Waimanu Gulch and the plateau and twelve or thirteen gulches between these two valleys. Every animal which has at all been exposed to the infection must be submitted to the mallein test and all reactors destroyed, regardless of whether they show physical symptoms or not. It is estimated that between two and three weeks will be required for the purpose and that the expense may be limited to the employment of three or four cowboys, with horses, at the regular wages paid such men. In case the neighboring plantations and ranches should be willing to provide a man each for this purpose, as was the case five years ago, only the cost of their food and lodging would have to be considered, besides my own traveling expenses.

So far as is now known, glanders has been eradicated from the entire Territory with the exception of this one corner. It would therefore seem a fitting climax if the complete eradication of this most destructive of all horse scourges could be announced in the next biennial report of the Board.

In compliance with further instructions from the Board I returned to Waipio Valley on November 13th.

As outlined, it was to be feared that many, if not all, of the horse stock belonging to Akaka were suffering from or at least had become infected with glanders from the seven clinical cases already destroyed.

The quarantine of the Valley has been continued, no horse stock from there being allowed to pass the Hamakua gate leading to Waimea and only the pack animals belonging to the taro planters, all of which had been found to be sound, had been allowed to carry paiai as far as Paauhau and to return immediately.

The first step upon my return was, therefore, to reinspect these animals, 41 in all, which was done at the mouth of the Valley at the top of the trail. When the animals fully loaded have climbed this steep trail, a continuous effort requiring about three-fourths of an hour, they are sure to show symptoms, especially a discharge from the nose, which otherwise might remain concealed; but, as stated, they were all found to be sound.

As far as Akaka was concerned, there remained quarantined at his place twenty-eight horses and one mule colt. One animal had died since my previous visit and three showed physical symptoms of the disease not visible when they were first examined. It was decided to submit all of these animals to the intradermal mallein test, a method which originated with this division. I first injected the saddle horses which my assistant and myself were riding, animals known to be absolutely sound, after which, with the same syringe and with mallein out of the same bottle, the twenty-eight animals belonging to Akaka were injected. This was no easy matter, as the operation is very delicate, requiring the use of an extremely fine hypodermic needle, and several of the animals had to be thrown down in order to secure them sufficiently to allow of the needle being inserted into the hide without penetrating it. On this point the success of the operation depends. If the needle penetrates the hide no reaction is obtained no matter how severely the animal might be affected. Only two drops are injected, generally on the side or the neck, the place of operation having first been disinfected.

The test proved an absolute success. Within one hour from the time of injection the minute swelling, originally the size of a small pea, had enlarged to the size of a hazelnut and in a number of cases the swelling had reached dimensions of four to five inches before we left the Valley that evening.

When the animals were seen again early the next morning they presented a very sorry appearance. In most of the cases the swelling was so painful that it was almost impossible for the animals to move the leg, and when approached for manipulation several of them nearly fell over in order to avoid being touched. In extremely contrasting condition were the swellings exhibited by my saddle horse and those of my assistants which had been injected at the same time. The swellings were barely the size of a bean and were neither sore nor hot.

This test must be considered an absolute triumph, and I have no doubt will be adopted the world over as soon as it becomes known. The method was first suggested by Dr. Case as a direct result of our work with the intradermal method of tuberculin testing. There is, however, a decided difference between the two tests, especially in the speed with which the mallein test appears and, furthermore, in the size of the swelling resulting from the injection. It can easily be understood, especially in a case like the present one where a man was going to be deprived of practically all of his work animals, depending upon whether they reacted to a test of which he had no knowledge whatever, that the fact that he could see for himself and compare their appearance with those that we were riding, that the method is far more satisfactory than the old subcutaneous method, which depends upon a series of temperatures being taken before and after injection, and which are absolutely unintelligible to an ignorant layman. There was consequently no objection, even though two of the animals did not give a decided reaction. These two were, however, retested two days later when they were found to respond to the test as well as any of the others. This demonstrates that in the first test the mallein must have escaped from the small pocket in the hide before it had time to set up any inflammation.

At this same time three more horses, also belonging to Akaka, the possession of which seemed to have escaped his mind, had been located and were found to react to the test. Further action pertaining to this matter is contained in my report to Mr. Waterhouse, acting chairman of the Board, of November 21, as follows:

"I am up against a problem that in a way is new to me, and I take the liberty to lay the matter before you, and, if you deem it necessary, I should very much like to have the Attorney General's opinion thereon. The facts are simply these:—Mr. Akaka, an aged Chinese rice planter in Waipio Valley, has glanders among his horse stock to an extent unprecedented in this Territory. What his losses have been previous to a few months ago I can only surmise, but of twelve young mules purchased at Waimea about four months ago not a single one remains; all have died from glanders. When I was here three weeks ago I destroyed 6 horses and one mule, all affected with typical glanders, and now, having tested with mallein his remaining twenty-seven head of horses I have found twenty-four of them to be suffering with glanders. Now, the law, that is, the rules and regulations of our Board, is plain enough on the subject, saying that any horse or mule found by the Territorial Veterinarian to be affected with glanders or farcy shall be destroyed, the carcass disposed of, premises disinfected, and so forth, at the owner's expense. This in connection with Mr. Giffard's instructions received this morning over the telephone from Hilo, and to the effect that I adhere to the law governing the subject would seem to leave me no option in the matter but to go ahead and slaughter the 24 affected animals, disinfect the premises and when satisfied that no more infected, suspicious or exposed animals remain in the neighborhood—return to Honolulu. There are, however, conditions and circumstances, not to mention precedents which seem to me to demand more explicit instructions or authorization before I proceed as indicated. Mr. Akaka was a comparatively rich man a few years ago, but through mismanagement of his business here, while on a visit to China, he returned to find himself very much reduced financially, in fact almost ruined. Unfavorable conditions made it difficult for him to regain what he had lost in spite of generous support from his friends, and the present difficulty which finds him indebted to the extent of $9,000.00 can result only in bankruptcy, if he is deprived of the means wherewith to harvest and market the now ripe crop of 55 to 60 tons of rice. Without any assurance of indemnification by the Government, I am told it will practically be impossible for him to borrow any more money wherewith to replace his work animals, without which the present crop and possibly the following one will be a total loss. Under these conditions you will undoubtedly understand why I am desirious of reassurance in regard to the apparently plain course outlined by our rules and regulations. As an American citizen, Mr. Akaka must have some inalienable rights, covered by constitutional or other laws, guaranteeing him against the deliberate though legal destruction of his means of making a legitimate living—pro bono publico—and, recollecting the ruling of the local courts, quite recently with regard to the destruction of the banana plants under Board of Health regulations, I would respectfully submit that the case under consideration is one not contemplated or anticipated when the rule pertaining thereto was promulgated.

"Now, Mr. Waterhouse, if, after reading this, you have come to the conclusion that I am borrowing trouble and that I should not bother the members of the board with such details after receiving plain instructions to enforce the law, I will only ask you to imagine yourself in my position, with an old man, palsied and with tears running down his face begging me to spare at least some of his animals, explaining over and over again in his nearly unintelligible pidgin English the unfortunate position he is in—and I doubt you would fancy yourself in my place. To me there is something awfully unjust in ruining the old man for the benefit of the community, and I have done what I could to get the neighboring plantations to help him out with a view to a reimbursement by the coming legislature. The matter, however, will have to be referred to Honolulu, and as I cannot remain here much longer, and as the *animals must be destroyed,* I sincerely hope you may be able to find some way or means that will allow me of holding out some hope of financial reimbursement or support for Mr. Akaka. When once the animals are killed he feels that there is little hope as then the danger of the spreading of the disease is gone. I have, however, promised to have the animals appraised in the regular manner in which it is done in States where indemnity is paid for animals destroyed under similar conditions, and prominent men have pledged their support of a bill to that effect. But that will hardly keep Akaka on his feet. Mr. Jorgensen, Manager of the Hamakua Ditch Company, leaves for Honolulu tomorrow, and will hand this letter to you. At his request I have promised to postpone the killing of Akaka's animals until I have finished the inspection and testing of all the animals in both Waipio and Waimanu Valleys. Tomorrow also we begin digging the trench in which to bury the affected animals. Then there is the disinfection, or rather destruction of Akaka's stables, as I doubt whether they can be disinfected without total destruction."

Instructions had been received by wireless message to have the animals appraised and for this purpose I appointed a committee consisting of Deputy Sheriff Lindsay from Waimea, Mr. R. S. Renfrew and Yung Hin, the latter representing the owner. Every animal was appraised separately and the value written on a piece of paper by each member of the committee, and handed to me, who folded and took charge of them for further use. It has, however, been reported already that the aggregate of the 28 animals came to $1,765.00, or approximately $63.00 per head. This sum, therefore, would constitute the basis upon which to attempt to obtain indemnification for Akaka by the coming legislature. But it is needless to say that with the present prices of horse stock hardly half of the number destroyed could be purchased with this sum of money.

On November 26th I received a wireless from Mr. Waterhouse instructing me to kill the animals referred to in my letter of November 21st, stating that it was probable that Akaka would receive assistance in securing other animals. In the meantime a large grave had been dug in the sand near the beach in Waipio Valley and on the 27th all of the animals were taken down there and destroyed and buried.

The subsequent work consisted in the total dismantling of Akaka's stables. By the courtesy of the Board of Health thirty pounds of corrosive sublimate were obtained and a trough built in which to dissolve the disinfectant so that all boards and other lumber which had been used in the old stables might be thoroughly soaked and disinfected before being placed in the new.

A virgin piece of ground at some distance from the old location and at a considerable elevation over the same was cleared and leveled for the erection of the new stables.

As stated in my report of November 21st, I had all of the horse stock in Waimanu Valley rounded up under the supervision of a police officer accompanied by three cowboys. Only 17 head of horses and donkeys were found, altogether, and all of them were found to be perfectly sound. The remaining days were spent in repeated inspections, and I feel certain that no cases of glanders remain in the Valley so far as it is possible at all to ascertain. It is, however, recommended that the animals in the Valley be inspected again, at least twice, at intervals of two or three months.

Upon my return I was pleased to meet Mr. O. L. Sorenson, Assistant Manager of the Parker Ranch, who informed me that he had been designated to act as an agent for a number of plantations, as well as for the Parker Ranch and the Hawaiian Irrigation Company, for the purpose of purchasing horses wherewith to enable Akaka to harvest his rice crop, thereby saving him from bankruptcy. Mr. Sorenson requested me to return to Kukuihaele with him, but as I considered Mr. Renfrew, the Board of Health inspector, perfectly capable of furnishing him all required information I decided that it would be better to return to Honolulu.

THE INTRADERMAL MALLEIN TEST.

In the study of the two diseases, tuberculosis and glanders, the attention of the observer is forcibly drawn to many points of similarity. Post mortem examination reveals lesions in the internal organs—lungs, liver, kidneys and lymph glands, macroscopically similar in the two diseases—miliary pulmonary glanders much resembling miliary pulmonary tuberculosis, as do also the single large nodules and abcesses in any of the above mentioned organs.

Considering the methods of diagnosis in the two diseases, the attention is again drawn to the similarity in many of them. We have the subcutaneous mallein and tuberculin tests; ocular or eye tests of greater or less value, and recently there has been developed the intradermal tuberculin test which is considered by us to be of greater practical value in the eradication of this disease than all the others combined. To continue the comparison:—the biological fluids used in the above methods of diagnosis are manufactured under similar conditions. The specific organisms in each disease is grown upon the same kind of media and the technique used in the production of the commercial fluids is the same in each case.

It was with these many points of similarity in mind, and with the knowledge of the immense practical value of the intradermal tuberculin test in the control and eradication of tuberculosis that we conceived the idea of an intradermal mallein test, and have demonstrated its practical value in the diagnosis of Glanders.

In making intradermal injections in either cattle or horses we have found that the syringe most convenient for the purpose is the small 1 cc. glass barrel syringe put out by the Cutter Laboratory of Berkeley, California. It is plainly marked in one-tenth cc. and in drops; light and easily handled and in fact suited to work of this nature·

The most convenient place of injection is the side of the neck at a point six or eight inches above the point of the shoulder. No special preparation is necessary although one can follow out the method used in subcutaneous tests if desired. We find it sufficient, if the hair is long, to cut it close to the skin and simply dip the needle in 5% carbolic acid before each injection.

As a rule, unless dealing with unbroken range horses, it is unnecessary to confine the animal, as the application of a twitch is sufficient in most cases. The operator should stand at the animal's side and with the syringe held at right angles to the long axis of the body, carefully insert the needle into the skin, which is held betwen the thumb and forefinger of the left hand, and slowly instill 2 drops of the mallein.

To do this correctly is not as easy as it looks, as it is surprising how thin the skin is in this region, in many horses. Where performed correctly one can feel the mallein force its way into the skin and remain there as a hard lump, the size of a pea, after the needle has been withdrawn.

Character of Reaction. A reaction to the intradermal mallein test consists of an inflammatory swelling at the point of injection, accompanied by heat and extreme sensitiveness, and varying in dimensions anywhere from four to six inches in diameter, considerably raised above the surface of the body and usually sharply circumscribed. In the large majority of cases, swollen and corded lymphatic vessels varying in number from one to five or six, emerge from the swelling to converge at the prescapular lymph glands in the region of the point of the shoulder. In many instances these lymph glands will be found to be somewhat enlarged and exhibit more or less tenderness.

The mallein used in these experiments was that prepared by the Federal Bureau of Animal Industry and is the same as is used in all subcutaneous tests.

Realizing that in the subcutaneous method of testing a local reaction occurs at the point of inoculation, which is considered by many to be the principal part of the symptom complex of a reaction, and realizing further that frequently good sized local swellings occur under the subcutaneous method in horses which have not been exposed to infection. we recognised the fact, that to establish an intradermal test of any value, by which the diagnosis depends entirely upon the presence or absence of a local reaction, we would have to use a mallein of such strength and a dose of such size that upon injection practically no local disturbance would be caused in a healthy animal, but a large, painful and otherwise characteristic reaction would occur in an animal affected with glanders.

Our first experiments were confined solely to the establishment of this minimum size of dose and strength of mallein, and a large number of apparently healthy horses, which had passed the subcutaneous mallein test, were used for this purpose.

The mallein employed in these experiments was the federal B. A. I. mallein reduced by evaporation to one-third of its volume; B. A. I. mallein reduced to one-half its volume; and the ordinary mallein as it is shipped in the bottles· The dose varied, starting at eight drops and being gradually diminished. It was soon seen that the mallein which had been reduced by evaporation to one-third and one-half volume were far too strong. Even in minute doses of one drop swellings varying in size from three to four inches would develop at the point of injection. and while in only a comparatively few cases at all painful, they would be liable to interfere with and to confuse a diagnosis. After much experimentation it was found that an intradermal injection of two drops of the B. A. I. mallein as used in the ordinary subcutaneous method and without alteration of any kind, produced in a healthy non-glandered animal, a painless swelling of about the size of a marble. In some cases a swelling the size of a dollar would appear but unaccompanied by either heat or pain. Having thus established the strength of serum and the size of the dose we waited with considerable interest our first case of glanders.

On December 5, 1910, our attention was called to a horse which was showing suspicious symptoms. The animal was removed at once to the Quarantine Station. Physical examination revealed swollen sub-maxillary glands and a bilateral discharge from the nose. The discharge was scant and of very suspicious character.

The horse was subjected to the subcutaneous test and gave a distinct, positive reaction, there being a very painful local swelling, 6" x 6" in size, with a typical temperature curve. A week later the ocular test was applied resulting in a positive reaction, there being marked suppurative conjunctivitis.

After another week this horse which had now given a positive reaction to two different methods of testing, was subjected to the intradermal test. Two drops of B. A. I. mallein were injected intradermally on the side of the neck. The same day three horses from the same stable and which had been in contact with this suspicious horse were treated similarly· As controls in the experiment our own three horses received a similar injection of mallein, from the same bottle.

Six hours after injection the swelling at the point of inoculation in the suspect had increased from the size of a pea, the original size of the injection, to a hot and extremely painful swelling 4" in diameter. The three contact animlas as well as the control horses exhibited swellings varying from the size of a bean to a nickel with neither heat nor tenderness. Four hours later, or ten hours after injection, the swelling in the suspect had reached 5½" in diameter with two swollen and corded lymphatics running to the point of the shoulder. Heat and pain were extreme. The local disturbance at the point of injection in the contact horses and control animals had all but disappeared.

Here we have demonstrated the speed with which a reaction will become apparent under the intradermal method of testing and the marked difference between a reactor and a non-reactor.

On July 19, 1912, we had an opportunity to apply the test to an advanced case of glanders. Physical examination revealed greatly swollen sub-maxillary glands; profuse discharge from both nostrils and large ulcers on the nasal septum. The history of the case brought to light the fact that about two months previous the animal had been subjected to a subcutaneous test by a local veterinarian and had given a positive reaction. Before any steps could be taken in the matter the owner had the animal removed to the hills where it was discovered later, and reported to this office.

The animal was subjected to the intradermal test and three other horses, known to be sound, were used as controls. Three hours after injection the swelling in the glandered animal measured three inches in diameter, hot and painful, while the swellings in the controls were scarcely noticable. Five hours later or eight hours after injection the glandered animal had developed a swelling four by five inches in diameter, clearly circumscribed, hot and extremely painful, with six swollen and corded lymphatics emerging from it and running to the point of the shoulder. A beautiful reaction and one typical of the intradermal method. The swellings in the controls had disappeared.

In order to test the accuracy of the intradermal method and to prove that a positive reaction would not appear in animals affected with diseases other than glanders, a mule affected with Epizootic Lymphangitis or Japanese Farcy, and a horse affected with Osteoporosis were subjected to the test. As controls, five horses which had passed the subcutaneous mallein test about two weeks before, and which were then held at the Quarantine Station received a similar dose administered in the same way.

Examination eight hours later revealed small non-painful swellings in all the animals injected, the two diseased ones as well as the five controls. This would indicate that a positive reaction to the intradermal test occurs only in an animal affected with glanders, and that the virus circulating in the blood of an animal suffering from some other disease has no effect upon this method. In this respect it has been proven superior to the subcutaneous method, to which, as is well known, horses used in the production of diptheria antitoxin will many times give a positive reaction, as is likewise the case with horses suffering from a heavy infestation of helminths·

Practical Application of the Method.

An opportunity for the practical applications of the method in the eradication of glanders occurred in December, 1912, when an outbreak of this disease occurred in Waipio Valley, Island of Hawaii. In all thirty-one horses, three of which were showing physical symptoms of the disease, and one mule colt were subjected to the test. As controls, the saddle horses used on the expedition and known to be absolutely sound were given a similar dose of mallein out of the same bottle and with the same syringe, these animals being injected first.

The test proved an absolute success. Within one hour from the time of injection, at noon, the minute swelling, originally about the size of a pea, had enlarged to the size of a hazelnut, and in a number of cases had reached dimensions of four or five inches before evening.

When the animals were seen again early the next morning they presented a very sorry appearance. In most of the cases the swelling was so painful that it was almost impossible for the animals to move the foreleg on the side of injection, and when approached for manipulation several of them nearly fell over in order to avoid being touched. In extreme contrast were the swellings exhibited by the saddle horses which had been injected at the same time. The swellings were the size of a bean or a hazelnut and were neither sore nor hot. Post-mortem examinations in connection with the physical symptoms fully proved the correctness of the diagnosis, as lesions of glanders were found in some part or other of the body in every case (the controls were not killed) and demonstrated the value of the intradermal mallein test in the detection of Glanders.

So far as we can judge this method of applying the mallein test deserves to be given a thorough trial, and will undoubtedly be adopted throughout the world as soon as further experimentation has established its value. While the great amount of work done here with the intradermal tuberculin test first directed our attention to the possibilities of the method in the diagnosis of glanders, and while there are some points of similarity, there is, however, a decided difference between the two tests, especially in the speed with which a reaction to the mallein test appears and, furthermore in the size of the swelling resulting from the injection.

In the first case the reaction begins almost from the moment of injection, and in most positive cases continues to increase in size with amazing rapidity so that it is frequently possible to pronounce a decided diagnosis within two hours after injecton, the swelling having by that time reached or even exceeded the size indicative of the presence of glanders.

Secondly the swelling very soon assumes an inflammatory condition, which is absolutely pathognomonic so far as our experience goes, and

Finally, when glanders is present, the swelling will continue to increase in size and remain characteristic for at least forty-eight hours and frequently for a week after injection, allowing the operator plenty of time for inspection, while the negative reaction will have completely disappeared in 24 to 36 hours, depending to a great extent upon whether the animal is worked or remaining quiet.

Since the tests upon which the above conclusions are based were finished the intradermal method has been applied to all the cavalry horses which were transferred from Hawaii to the mainland when the 5th U. S. Cavalry was ordered back to Arizona, and not a single reaction has been observed.

CONCLUSIONS.

As indicated by the old subcutaneous test, the toxins, or the biological products resulting from the presence of the glanders infection in the system, are undoubtedly stored or accumulated in the cutis to an extraordinary degree. The mere passing of the needle, charged with mallein, through the skin, in connection with what mallein might be forced back from the subcutaneous tissue into the canal formed in the skin, was sufficient, in most cases of glanders, to produce a decided swelling at the place of injection, the so-called local reaction· This amount could at the best be not more than a fraction of a drop. It would therefore seem natural to conclude that the injection of one or two drops directly into this hypersensitive tissue must result in a far more decided reaction,.which we believe our experiments have demonstrated.

To enumerate two advantages of a method which allows of a positive diagnosis being made within a few hours, requiring only the approach of the animal one time for the fraction of a minute —the animal being qualified for the test under any or all conditions and circumstances—would seem unnecessary. That the owner of a suspicious animal can see for himself, especially if one or more controls are injected, whether his horse is to be condemned or not, allays his doubts and obviates arguments, discontent, enmity and litigation.

We respectfully ask our confreres and colleagues who have the opportunity to give the method a trial and to report their results.

RABIES IN DOGS AND HYDROPHOBIA IN MAN.

PREVALENCE OF THE DISEASE IN THE UNITED STATES AND FOREIGN COUNTRIES AND MEASURES ADOPTED TO PREVENT ITS INTRODUCTION INTO THE TERRITORY.

Introduction.

Under date of November 30, 1911. the Territorial Veterinarian reported to the Board as follows:

"My attention having been called to the fact that a prominent visiting surgeon and federal officer had expressed surprise that the regulations of this Board governing the importation of animals contained no safeguard against the introduction of rabies in dogs or hydrophobia in man, I beg to submit that there has been on file in my office a copy of a regulation, marked No. 1, and which was written by me nearly seven years ago, and which pertains to the quarantining of all dogs for a period of three months from the date of landing in the Territory, the reason for the same being "the total absence of a disease known as rabies or hydrophobia, and which attacks all domestic animals as well as man, with invariably fatal results, and the introduction of which would be a serious menace to the welfare of the community as well as to the live stock interests of the Territory." This regulation was submitted at the very first meeting of the Board which I attended in July, 1905, but the Board found it inexpedient to approve of it. When, during the early part of this year, the annual report of the State Veterinarian of California was received, and it was learned that rabies was prevalent to a great extent among the dogs and other domestic animals in California, I again called the Board's attention to the necessity of a stringent regulation for the prevention of the introduction of this disease, but action on the same was again postponed.

"Now that the subject has been brought up again it might be well to review the present situation in so far as the prevalence of the disease in question is concerned in order to reach a definite conclusion as to the necessity for the promulgation of a rule, which of necessity must be stringent and which undoubtedly will meet with great opposition and cause much annoyance and dissatisfaction."

Prevalence of Rabies in the U. S.

In the last Annual Report of the U. S. Bureau of Animal Industry there appeared an article entitled "The Nature, Cause and Prevalence of Rabies" by Dr. John R. Mohler, Chief of the Pathological Division. Under the sub-head of "Distribution and Prevalence" the author gives a concise account of the spread of the disease in the United States during the past ten years and while he disclaims any intention of assuming the part of an alarmist with reference to the increasing prevalence of rabies, he says that it cannot be denied that there is at present unusual occasion for alarm in certain parts of the country. Up to 1899 the disease was rare in the United States except in Pennsylvania and Massachusetts and was unknown west of the Rockies. In 1900, however, the disease had made its appearance in Montana, Wyoming and Colorado, and during the succeeding years the numbers of outbreaks reported by State Veterinarians and other sanitary officials showed a steady increase both in localities and in the number of animals affected. A summary of all available and authentic information at the disposal of the author indicates that at the time of writing (June, 1910,)—"the disease occurs in nearly every State in the Union, and the only places where it has been impossible to obtain positive information are Idaho, Utah, Nevada and Oregon, while in the State of Washington there has been an outbreak which was quickly suppressed seven years ago." The establishment throughout the United States of Pasteur Institutes for the treatment of persons bitten by rabid dogs is likewise an indication of the spread of the disease and the reports from the institutes show that hundreds of people receive the treatment annually (nearly 1500 in 1908). The vital statistics of the Census Bureau shows the following increase in the disease in man:—In 1903, 43 people died of hydrophobia; in 1904, 38; in 1905, 44; in 1906, 85; in 1907, 75; in 1908, 82. These deaths occurred only in the registration area of the United States, which now includes about 51 per cent of the total population.

Rabies in California.

In his annual report for the period ending June 30, 1910, the State Veterinanrian for California says that in the fall of 1909 reports were received at his office of dogs with rabies in the City of Los Angeles, but also from Pasadena, Stockton and Riverside. The diagnosis of rabies was established beyond doubt by microscopical examination as well as by inoculation experiments. Reports of the existence of the disease in human beings, horses and cats were also received and as several hundred cases of rabies in dogs were reported by the veterinarians in the vicinity of Los Angeles and Stockton, the State Veterinarian declared the disease to be now endemic in California. Muzzling ordinances were enacted by the municipal authorities in Stockton, Los Angeles and Pasadena, but were repealed too quickly.

From the above it may be definitely concluded that rabies is prevalent in the United States and especially so in our neighbor State, California. Before discussing measures against its introduction into the Territory it will be necessary to say a few words in regard to the characteristics of the disease and its manner of transmission.

Nature, Cause and Transmission of Rabies.

Rabies is a specific communicable disease, pre-eminently affecting the canine race, although all warm-blooded animals, including man, are susceptible to it. For centuries before the dawn of civilization the disease was known and dreaded, and the advent of science has not even yet succeeded in fully dispelling the fallacies and superstitions which have clung to it for so many years. Rabies is transmitted only by animals that are actually diseased at the time the bite is inflicted, and, under natural conditions, this is the sole method by which the disease is transmitted, though artificially it may be readily produced by inoculating susceptible animals with an emulsion of the brain or spinal cord or with the saliva or milk of the affected animal. Next to the canine race, cattle are most commonly affected, probably because rabid dogs next to their morbid desire to attack members of their own race, have a better opportunity to bite grazing cattle than any other species of animals. Every animal or person bitten does not necessarily develop the disease. In man the percentage is estimated at about 15, though considerably higher following bites by the wolf. Among dogs about 40 per cent of the animals bitten develop the disease, while in cattle, hogs and horses the percentage is respectively 25, 35 and 40. Much, however, depends upon the size and location of the wound. The nearer the bite is located to the central nervous system the greater the danger of a fatal result. When deposited in the wound the virus remains latent for an extremely variant period of time, but not until it has found its way along the nerves and spinal cord to the brain do the symptoms appear. This period of incubation varies from 14 to 285 days. The great majority, however, develop the disease in 3 weeks to 3 months after the bite has been afflicted. This is of importance in considering preventive measures.

Symptoms of Rabies.

The disease manifests itself in dogs in two distinct types, the furious and the dumb type. The most characteristic early symptom is a decided and apparently causeless change in the natural disposition of the dog. Pet animals appear suddenly to become morose and irritable while less affectionate animals show a desire to be petted. The cardinal symptom, however, is restlessness. The dog is constantly moving and barks and growls on slight provocation, and may, if not restrained, leave home and wander off at great distances to return in a day or two exhausted and greatly changed in appearance. It is during the wandering period that the dog generally bites people and other animals. While he does not appear to go out of the way to attack, he resents any interference with his movements and bites at what comes in his way. A rabid dog at this stage encountering a herd of cattle may inflict wounds on a dozen or more within a few minutes. There is no appetite for food but he will bite at and swallow indigestible stuff, as wood and stones. The act of swallowing soon becomes difficult and later in the disease, is impossible. At the same time convulsions appear, during one of which the animal dies. In the dumb form paralysis of the lower jaw and throat is characteristic. The voice is greatly changed, to a dismal, hoarse howl, which when heard once is never forgotten. The animal seeks a secluded place and dies when the paralysis reaches the respiratory center.

In the horse the symptoms are of the furious type denoting unspeakable suffering and mortal anguish. I have seen horses tear the hide and muscles from the bone with their teeth at the place where the bite was inflicted weeks before, or rub the nose and face against the sides of the stall until all of the soft tissues were worn away. In human beings, unless palliated by narcotics, the suffering is still more intense, and as Mohler says in the article quoted above: "Anyone who has seen the suffering of a human being affected with this fatal disease, will readily conclude, that no amount of inconvenience caused animals by muzzling or other protective arrangements can ever be considered too much to prevent such suffering."

Danger of Introduction into the Territory.

From this it will appear that rabies in dogs or other animals, or hydrophobia in man, are diseases which we do not want in the Territory, and when we consider the number of dogs which annually arrive here from the Mainland, and further consider that our isolated, geographical position affords no protection on account of the long period of incubation, then it is indeed a wonder that the disease has not gained an entrance here long ago. The perfunctory inspection of dogs as now carried on, affords no protection against the disease unless it happened that an infected animal developed the disease before reaching here, and that is not likely to occur as three weeks may be considered the minimum time of incubation under ordinary circumstances.

What the results would be should the disease gain entrance here is easily imagined. The natural fondness of the native population for dogs would make them and their children easy victims and the opposition which a muzzling order or other measures or restraint of dogs would meet would render the enforcement, to say the least, difficult. The invariable tendency of an infected animal to leave home and to travel for days over the country—some have been known to travel between 90 and 100 miles and to bite from 20 to 40 animals and persons on the trip—would scatter the disease as infallibly as were it mosquito borne, and I doubt whether any measure short of eradication would suffice to stamp out the infection.

Period of Incubation in Rabies.

We must, however, bear in mind that whether it is due to good luck or to some unknown protective agency or circumstance, hundreds of dogs have arrived here for years without bringing the disease with them, and while the disease formerly was not as prevalent as it is at the present time, the very fact that it is generally known that the Territory imposes a rigid inspection on all animals, may have tended to keep many undesirable, and, possibly also, some infected dogs away from here.

A protective quarantine measure must of necessity require the keeping under observation of the respective animals for at least the period of incubation, after removal from the infected district. In the case of rabies the period is very long and has been fixed at three to six months by those communities which have successfully eradicated the disease from within their borders and made a determined effort to keep it out. The mean length of the period is, according to Pasteur, from 40 to 60 days, in some cases even one to two years, but they are very rare. Consequently if the Board from the above should decide on a regulation for the absolute safeguarding against the introduction of rabies, the first step is to decide on the length of the quarantine period. My opinion on this point is that anything short of 90 days is not to be considered.

Rabies Regulation.

A regulation of this kind would have a tendency to prevent the introduction of anything but high class animals, and as these in most cases would come from kennels where they had been born and raised there would be less risk, and additional safeguard may be obtained through certificates from the breeder as well as from the local health officers as to the presence or absence from the State, County or District of rabies for a greater or less period before shipment.

Warning to Tourists.

Another point to be considered would be the arrival at San Francisco of tourists and visitors destined for these Islands and bringing with them dogs, which they might have left behind at their homes but which they would neither leave in San Francisco nor submit to a lengthy quarantine upon arrival here. While this point is but a mole hill when the health and welfare of the community is concerned it will undoubtedly be made into a mountain, as ruinous to the tourist trade, and while perhaps an insignificant number of such cases might occur in the course of a year, I am very much mistaken if it will not be made to turn hundreds of visitors away from here by the eventual opponents to the measure. This may, however, be overcome to a certain extent at least, by the aid of the folders and other printed matter of the Promotion Committee, while a printed notice to be posted in all steamship offices on the Coast might call the attention of purchasers of transportation to the Islands to the contemplated restrictions on dogs thereby avoiding the turning back of passengers with dogs when boarding the steamers at the last moment before embarking.

Finally there is the cost of constructing suitable quarters for the animals to be considered, as well as their care and keep while in quarantine. So far as I remember a charge of $10.00 per month is exacted for care and keep in New Zealand. This undoubtedly would prove a hardship in many cases, at least so far as immigrants or homesteaders might be concerned, unless the Territory should remit the charges in such cases.

On the basis of the above the following regulation was adopted by the Board, and the same has so far proved effective in keeping the disease from gaining entrance here:—

RULE AND REGULATION OF THE BOARD OF COMMISSIONERS OF AGRICULTURE AND FORESTRY CONCERNING THE QUARANTINE OF DOGS FOR RABIES.

The Board of Commissioners of Agriculture and Forestry of the Territory of Hawaii hereby make the following rules and regulations:

Owing to the prevalence in the United States and other countries of a disease known as rabies or hydrophobia, which attacks dogs, other domestic animals, and also man, with invariably fatal results, and whereas the disease up to the present time is unknown in the Territory of Hawaii, and its introduction would be a serious menace to the welfare of the community as well as to the local live stock interests, it is hereby ordered:

That all dogs arriving in the Territory of Hawaii and coming from or through any country, state or territory where rabies is known to exist, shall be kept in quarantine, on premises provided by this Board, for a period of 120 days, or for such longer period, not to exceed 180 days, counting from the date of embarkation as, in the judgment of the Board shall be necessary.

Any person or party contemplating the importation of dogs to this Territory shall apply to the Board for a Permit of Importation, said application to be made on blanks provided by this Board, setting forth the country, state, territory, district or locality rom which the dog or dogs are to be obtained, the port from which shipment is to be made, the routing and manner of shipment from the place of origin to the said port, and the various ports, if any, where the ship or vessel will touch before arrival in this Territory.

If satisfied that rabies does not exist in the country whence such dogs are to be imported and that shipment can be made in such manner as to exclude the possibility of infection in transit, the Board will issue such Permit of Importation, which shall entitle the dog or dogs therein specified to admission to the Territory without detention, except for such period as the Board may require to satisfy itself that all conditions have been complied with and that the animal or animals are not suffering from rabies or any other infectious or contagious disease which would bar their admission under the rules and regulations now in force.

It shall be the duty of the Territorial Veterinarian, or his assistants, to meet all incoming steamers and other vessels, to receive and transport to the Animal Quarantine Station all dogs intended for importation into the Territory.

Dogs, which belong to steamers or other vessels, their officers or crew, or other dogs on board such vessels destined for a further port,

must be securely confined on board as directed by the Territorial Veterinarian or his assistants as long as the steamer or vessel remains in port. No other dogs shall be allowed on board unless intended for exportation, in which case they shall remain on board when once brought there, and must be confined in the same manner as above described.

The Territorial Veterinarian shall keep at his office at the Quarantine Station a ledger in which shall be entered on a separate page for each dog, the date of arrival, the name of the owner, agent or consignee, a complete description of the dog, for the purpose of identification, a statement of the apparent health of the animal upon arrival and subsequent notes and dates of visits of the inspecting officer. In another ledger shall be entered all expenses incurred for the keep, comfort and medical or surgical treatment, if required, of each individual animal. Both ledgers shall be open to the inspection of owners, agents or consignees so long as their dogs remain in quarantine.

All costs in connection with such quarantine shall be borne by the owner, agent or consignee, and no dog shall be released from quarantine until such costs are paid.

Until further notice the port of Honolulu shall constitute the only port through which dogs may enter the Territory.

This rule shall take effect on the first day of March, 1912.

APPROVED this 27th day of January, 1912.

W. F. FREAR,
Governor of Hawaii.

THE DOG QUARANTINE STATION.

When the animal quarantine station was built in 1909 provision was made for the arrival here of shipments of hogs affected with cholera. An enclosure, 90′ by 130′, enclosed by a solid board fence, was set aside for this purpose, but since no hogs have been imported for the past three or four years, the enclosure has never been used and the projected slaughter and rendering facilities were never installed. This enclosure therefore came in handy when it became necessary to add quarantine premises for dogs to the station, and here, at an expense of approximately $1500, the kennels were built. There are 18 separate kennels made: for small dogs, such as toy and lap dogs, 4; for medium-sized dogs up to the Ayrdale, 5; for large dogs, 3; and for families, or for more than one dog belonging to the same owner, 6. These latter can be divided, by a solid partition, so as to make room for two dogs, independent of each other.

The construction of the kennels is very solid, the enclosure consisting of a frame work of 4″ x 4″ uprights, set two feet in the ground, connected with 2″ x 4″ sills, plates and crosspieces, the top being covered with chicken wire, while the sides and doors are made of very stout ornamental wire fence, such as is used for garden or graveyard enclosures. A footboard of 2″ x 12″

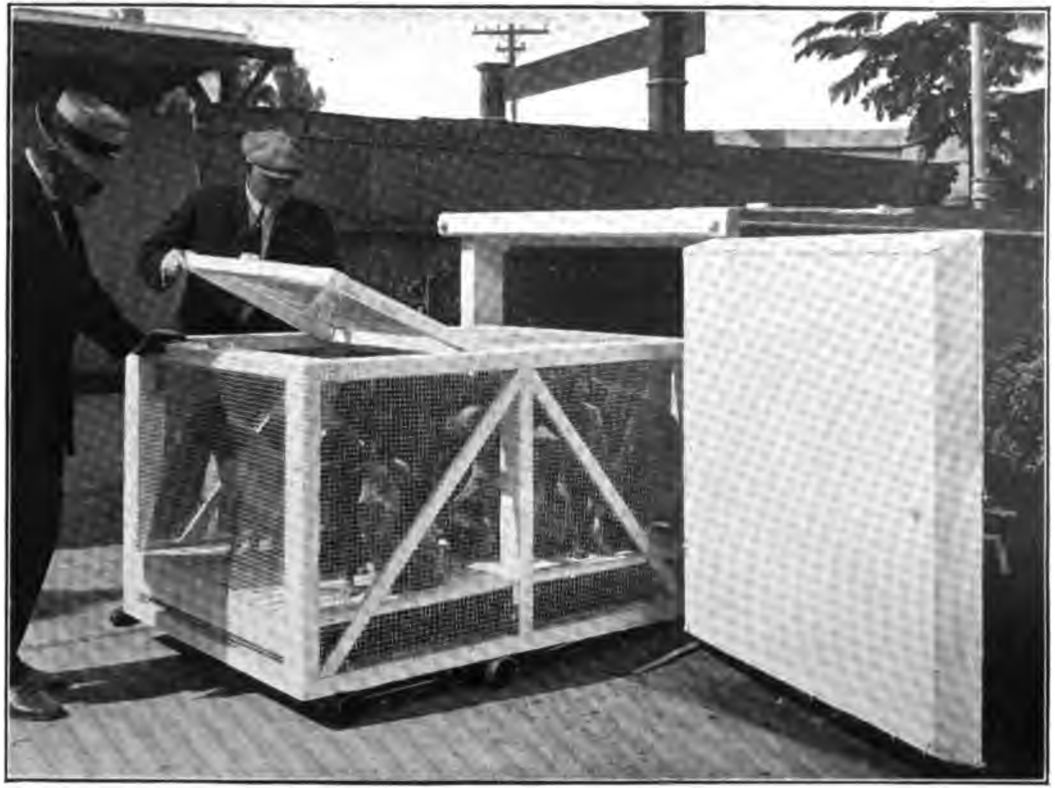


Plate 28. **Dog Quarantine. The Lethal Chamber. Fifteen mangy dogs ready for the gas.**

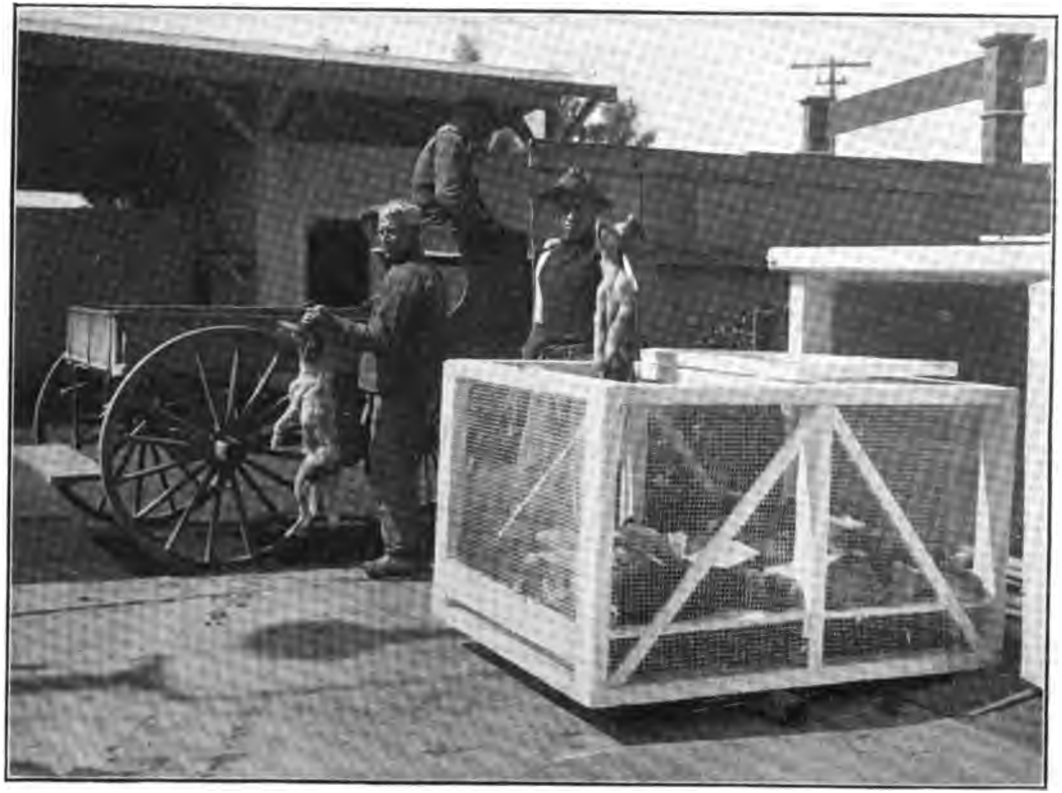


Plate 29. **Dog Quarantine. The Lethal Chamber.**
Six minutes after the preceding picture.

N. W., set 9" in the ground and on the outside of the sill, to which the wire is stapled, prevents the dogs from digging out.

One-third of the ground space to the rear, or opposite the door, is covered by concrete, on which stands the house, the bottom of which is 8" above the concrete, resting on four legs. The four sides of the house are held together only by eight screws, both top and bottom being loose, so they can easily be taken down for disinfecting, cleaning or for storage when not in use. In hot weather the open front may be turned in any direction whence comes the most air, and the top may be raised in any direction and to any extent desired.

The station is located on the beach, the foundation being coral and sand, with a very scant covering of soil, which is easily removed and replaced with white sand. When the tide is high the ground water rises to within 24" of the surface, thereby providing a universal sewer under the entire station and completely obviating any smell of dog. With the trade winds blowing almost constantly from the mountains toward the sea, the temperature never becomes oppressive, and when in rare instances a south wind prevails the air may be cooled by rotating sprays, while the enclosures are shaded with tent flies. A concrete swimming tank, set in a 12' x 15' enclosure, under a corrugated iron roof, also affords relief to long-haired dogs during warm weather, and serves to rinse the dogs after a disinfecting bath. Another roofed enclosure contains operating table, sink, telephone, medicine and instrument chests, and serves for the preparation of food.

Every dog is allowed the run of the yard in which the swimming tank is located, for half an hour every day, and the fact that no single case of sickness has occurred among the 110 dogs which have been confined in the station since the rabies regulation went into effect, speaks well for the sanitation and hygiene of the place, as well as for the care and comfort bestowed upon the animals during the extended confinement.

The plates show the general construction and location under shade trees, as well as the nature and appearance of the wire fencing used for the kennels.

THE ERADICATION OF MANGY DOGS IN HONOLULU.

A lengthy article on this subject had been prepared for publication in this report, but for want of space the same had to be cut out. The accompanying illustrations show the manner in which unlicensed dogs are disposed of, the means being the ordinary illuminating gas, as prepared from crude oil and supplied for household purposes in Honolulu. The method and the arrangement of the lethal chamber have been copied from the San Francisco establishment for the Prevention of Cruelty to Animals, to whom credit is hereby given for this most ingenuous way of disposing of ownerless and diseased dogs and cats.

The chamber, which is built on the refrigerator plan, can undoubtedly be made of much lighter or cheaper construction, as it is simply required to retain the gas for a few minutes. Two windows on top allow of the observation of the animals while passing through the agony, and it must be admitted that no dog owner, however tender hearted, can object to the method when reconciled to the fact that a canine pet must be put out of the way. As observed through the window there is no struggle, pain or suffering—a slight uneasiness when the smell of the gas first reaches the nostrils, then drowsiness and the feet gently slide away from under the victims and they do not move again. Less than two minutes is required from the time the gas fills the chamber until all the enclosed dogs are prone on their sides.

The cage will hold about twenty medium-sized dogs, which it requires less than ten cents worth of gas to destroy.

This is absolutely the most humane as well as the cheapest way of destroying animals that the writers have ever encountered. It is to be hoped that every unlicensed dog in Honolulu will be apprehended and disposed of shortly and the danger of hydrophobia thereby minimized.

A PECULIAR DISEASE AMONG THE SHEEP ON THE ISLAND OF LANAI.

For a number of years losses have occurred among the sheep on Lanai, the number of deaths varying from three or four to fifteen to twenty a day. The heaviest loss usually occurs during the winter months, i. e. November to March. It seems to follow very closely the changes in climatic conditions, the greater number of deaths occurring during the wet period when the atmosphere is damp and chill and ceasing almost entirely on the return of a dry warm period.

Probably the greatest loss has occurred at shearing when at times from two to three hundred would die over night. It is interesting to note that this great mortality occurred entirely among sheep brought from the lower levels, no loss being observed among the sheep brought from the higher elevations. By the construction of shearing pens at an elevation not subject to the mist and chill of evening this loss has been entirely stopped.

For the most part the pasture land is covered with a rank overgrowth of Manienie grass, a large part of which the sheep will not eat unless forced to do so as it is not palatable, is more or less a stringent and contains little or no nutriment. That they are forced to eat more or less of this dry material is apparent from the lack of nutritious grasses and weeds and the small amount of young, green Manienie. Very little has been done in the past to improve the land and bring it to such condition as would maintain flocks at a profit. The reduction of the size of the pastures by fencing and the burning, ploughing and seeding which is now being done is a move in the right direction and will rapidly improve the land.

Condition of Native Sheep.

The native sheep on Lanai show the effect of long close-breeding in their small size, weakened constitution, lack of vitality and stamina. In-breeding while a powerful factor in point-breeding, i. e. the production of an animal having all the good qualities of its ancestors and having the ability to transmit the same to his off-spring, tends, when misused or continued for a long time, without the introduction of new blood, to weaken the vitality and so lessen the animal's powers of resistance to any infectious or contagious disease. The condition of the range, the constant in-breeding and non-introduction of virile blood, the presence of scab with its weakening and debilitating effect upon the system have all tended to the production of animals of low powers of resistance.

That the majority of the stock are in a weak and poorly nourished condition is evidenced by the shape in which shipments reach the Honolulu market, being in an exhausted condition upon arrival and on the killing floor dress out very light and show a medium quality of mutton. This then, being the condition of the stock, particularly on the lower levels, it is not strange that a large number should succumb to an affection, which, it is our belief, would cause little loss were they in a strong, healthy and well nourished condition.

Symptoms.

The animal presents almost exclusively what might be termed brain symptoms. At first there is extreme dullness and apathy and the patient ceases grazing. In the majority of instances the animal is lying down but when standing the back is arched and head drooping; it walks with difficulty and stiff legged and is seized with intermittent spasms. The breathing is irregular and catchy; the eyes at times staring and the pupils may be dilated; there is entire absence of frothy, bloody discharge from nose or anus but in many cases there seemed to be increased salivation. In the final stage when lying down there are spasmdoic movements of the body and limbs, grinding of the teeth and diviation of the eyes. Death approaches rapidly and terminates in convulsions, the final position generally being more or less extreme opisthotonos.

Pathology.

Outside of the brain and anterior portion of the spinal cord post-mortem examinations have failed to reveal any lesions of a specific nature. Putrifactive changes, more or less advanced, have been the only conditions met with. Upon examining the brain and spinal cord, however, we meet with a series of changes not due to putrifactive organisms. Here, in each case, on carefully removing the brain-cap, the network of superficial vessels were found to be greatly engorged with blood. There is an increase of fluid in the lateral ventricles, while the fourth ventricle contains much more fluid than normal which is more or less colored from a transudation of red blood cells and the lining membrane is highly congested; the blood vessels of the medulla-oblongata and anterior portion of the spinal cord are usually greatly congested.

Bacteriology.

Inoculations were made into gelatin agar and plain agar, both on slants and into long tubes for the presence of anaerobic organisms. The material was taken from the liver, heart's blood and the hemorrhage areas sometimes found in the mucous membrane of the abomasum. The tubes were incubated at different temperatures, some at room temperature (22° C) and others at incubator temperature (37° C).

A variety of organisms were thus cultivated, chiefly micrococci and putrifactive organisms. From one specimen of blood we obtained a sporulating, gas producing anaerobic bacterium forming small grey colonies with a white center, in the substance of the medium, the gas produced amounted to a few bubbles with a very foul odor. This organism varied in size from 4 to 8 microns in length and 1 micron in breadth staining evenly throughout—spore formation taking place in the end of the organism. No significance can be attached to these organisms as they do not occur with any regularity and are undoubtedly a form of putrifactive organism.

Classification.

When first investigating this disease it was thought from the suddenness of the attack and rapidity of death that it might be

Braxy but when we compare the two diseases we find numerous important points of difference.

Professor Gilruth of the University of Melbourne in his article entitled "The Braxy Type of Sheep Disease in Australia" describes typical cases of Braxy. That we are dealing with another and entirely different disease is evident upon comparison. He describes his disease as "occurring only during the dry weather of summer, and practically disappearing after the coming of the general autumn rains, when only rarely is an animal dead of the disease seen"—exactly opposite from the conditions observed on Lanai. Again he states regarding symptoms—"Seldom are any evidences of sickness observed, so much so that one sheep owner who had had ten years' experience of its ravages, during that period only observed two living cases. At the most some dullness and disinclination to move may be detected but this is rare—Death occurs quietly, there never being any evidence of struggling." In another place he remarks: "The attitude is generally that of sleep, and there is no evidence of struggling prior to death."

How different this is from the conditions found on Lanai where in every instance death occurs in a series of convulsions, the final position giving evidence of the death struggle.

In describing the post-mortem appearances in his cases he calls attention to the "patches of gelatinous subcutaneous oedema, slightly blood-tinged, particularly about the thorax and abdomen, on removal of the skin." These areas are more or less emphysematous. Of the more or less hemorrhagic condition of the fourth stomach and duodeum. In fact he depicts typical post-mortem lesions of Braxy. No such conditions have been found in any post-mortem examination made on the sheep of Lanai. The lesions constantly found in Braxy, i. e.—hemorrhagic areas in the mucous membrane of the abomasum and duodeum, and the serosanguinous, emphysematous, subcutaneous areas have been absent in every case. Finally, Dr. Gilruth has been able to isolate the particular organism of Braxy, grow it on special media and transmit the disease to healthy sheep by inoculation. From the above comparisons we can draw but the one conclusion that we are not dealing with Braxy but have an entirely different affection.

The symptomatology and post-mortem findings classifies the affection on Lanai as an acute form of Cerebro-spinal Meningitis brought on from eating rank Manienie which has become musty and mouldy. That the course of the disease is so rapid and the mortality so high is due, in our opinion to the generally weakened and debilitated condition of the animals.

The symptoms as observed follow very closely those given by Dr. James Law for Cerebro-spinal Meningitis as occurring in sheep. He states:

> **"The attack comes on with weakness, dullness, lethargy, salivation, convulsions and oposthotonos, grinding of the teeth, succussions of the body and limbs. . . The congestion of the head, of the encephalic muscous membranes, and the deviation of the eyes are constant features."**

Prevention and Treatment.

Medicinal treatment is at best very uncertain and hardly practicable under range conditions. The only hope is in preventive treatment and all efforts should be made in this direction. The land should be fenced into paddocks of a size not too large for proper handling. The rank Manienie should be burned and the land ploughed. The ploughing is a very important part as the soil needs thorough aeration to insure destruction of any germs which may be present.

The burning and ploughing should be followed by seeding such grasses as are suitable for the range. By so doing the pasture will become stocked with valuable nutritious grasses and will maintain flocks at a profit.

EYE WORM IN CHICKENS.

Characterization.

A parasitism prevalent among chickens in these islands resulting in more or less loss and characterized by the presence of the Filaria or Oxyspisura Mansoni in one or both eyes.

History and Distribution.

The species was first referred to by Cobbold as occurring in the eyes of chickens in China. He writes as follows:—

"Here I may mention that on the 10th of April, 1878, I received a letter from Doctor Manson of Amoy, announcing his acquaintance with a filaria infesting the eye of the fowl. On the 9th of May, I also received from Doctor Manson the head of a bird showing examples of the worm. As the species is new to science I have proposed to call it Filaria Mansoni, after the discoverer. The male is five-eighths inch and the female three-fourths inch in length."

The next observer to encounter this worm was Magalhaes (1888) who describes specimens collected in Brazil, five from the eye of a fowl and two from the eye of a peacock.

Emmerez and Megnin (1901) describe a peculiar opthalmia among chickens on the island of Mauritius, which was doubtless caused by a filaria. In their descriptions they state:—

"It begins as an ordinary opthalmia. The bird affected appears uneasy and scratches at its eyes, which become inflamed and watery. The eye lids stick together and a white cheesy matter, easily removed, gathers behind them. At other times there is a complication of nasal catarrh, together with great inflammation of the infra-ocular sinuses· In such cases the condition of the bird may be considered very serious. With its eyes almost always closed it remains in one place, eats but little and with difficulty, becomes anemic, and dies in twenty to thirty days."

In 1901 and 1902 Mr. F. C. Clark collected numerous speciments at Laughlands, Jamaica.

It is interesting to note the fact that so far the worm has been reported only from localities on or near the seacoast.

The parasite was doubtless brought to these islands by importations of fowls from China and Japan. It is found in all parts of the islands though more abundant in some localities than in others.

Etiology.

The worm which causes the trouble and which is known as the Filaria Mansoni belongs to the Nematode or Round Worm group. They are capillary worms, silvery white in color and tapering gradually toward each end. The posterior end is more pointed, and in the male is more or less curved ventrally, while in the female it is straight. The male is from 10 mm. to 14 mm. and the female from 12 mm. to 18 mm. in length.

Symptoms.

The presence of these worms in the eye frequently causes the patient no apparent inconvenience and at times birds will be found harboring from 50 to 100 worms in each eye without any ocular irritation·

The most noticable symptom is a more or less severe conjunctivitis in the affected eye or eyes. The part the worm plays is purely a mechanical one, interfering with the normal working of the eye and setting up the usual irritation caused by the presence of a foreign body. When the irritation and resulting conjunctivitis is very severe the eye is greatly inflamed and badly swollen, the discharge serious at first soon becomes mucopurulent in character and forms yellowish crusts around the margin of the lids: the bird is constantly rubbing the head against the wings which become smeared with the discharge. Every morning finds the affected eye closed tight, the lids being held closely adherent by the purulent secretions but in a short time by constant rubbing the eye may be opened a little.

When one eye only is affected there is little or no apparent effect upon the general health of the bird; it remains lively and keeps in good flesh. In the mild type the eye soon clears after the worms have been removed, but in severe cases the inflammation increases with the result that the sight is impaired and the eye lost. When both eyes are affected the result is total blindness. The bird stands with head drawn in toward the body and the feathers ruffled; driven on by hunger it moves uncertainly here and there in search of food and makes ineffectual efforts to pick up things from the ground. The natural result of such a condition is starvation and death.

Treatment.

The treatment consists in removal of the worms from the eye either by direct mechanical means (a pair of fine forceps) which is more or less painful to the bird, or by irrigating the eye with some bland solution such as bicarbonate of soda, or a one to two percent' solution of creolin or chloro-naptholeum which dislodges them when they can be wiped away with a soft cloth. Having removed the worms, treatment is now directed against the conjunctivitis or inflammation of the eye which may be present. In severe cases which have been allowed to run some time medicinal treatment is of little avail. The man who wishes to make a success of poultry raising must of necessity keep close watch of his stock. No case is severe in the beginning although some develop more rapidly than others. Irrigation of the eyes with a mild antiseptic solution, such as a four percent solution of Boric Acid in water, or a one percent creolin solution is indicated, together with irrigation also of the nose and mouth if the nostrils are affected. Stimulating and nourishing food should be furnished to keep up the vitality of the patient.

Prophylaxis or Prevention.

No special prophylactic treatment can be advised as the life history of the parasites is up to the present time unknown. Certain general precautions to prevent the spread of this as well as of other parasitis diseases should. however, be taken. Affected fowls should be isolated· The chicken houses should be kept clean and disinfected frequently by the use of boiling water and whitewash to which has been added five percent of carbolic acid, creolin, chloro-naptholeum or some other disinfectant. The yards likewise should be kept clean and free from excessive moisture. Chickens should not be allowed to drink from stagnant pools, but pure drinking water should be furnished in vessels which can be frequently cleaned.

Report of the Deputy Territorial Veterinarian for the Hilo District.

By

H. B. ELLIOT, M. R. C. V. S.

GENERAL OBSERVATIONS.

The steady improvement in the conditions affecting live stock noted in previous reports has been maintained during the period under review. Inspection of imported animals at points of shipment, effective quarantine regulations at ports of entry, the constant eradication of contagious disease, and the much greater attention devoted by stock owners to the care and shelter of their animals are all measures which have more than justified the extra outlays necessitated by their adoption. Glanders and osteoporosis have been almost entirely eliminated; contagious endemics of catarrhal disease have proved amenable to control under suitable methods of prophylaxis and treatment; and even the commoner disorders of the equine population, such as colics and enteritis, have been diminished by improved and better methods of feeding.

On the less favorable side of the ledger we have a number of diseases whose presence is, from various reasons, always a menace to the owner of animals. Epizootic cerebro-spinal meningitis, despite its infrequent local occurrence, affords anxiety because of its occasional destructive spread and our lack of exact knowledge regarding its nature and causation. It will be seen in this report that tetanus has shown a sudden and almost startling increase in the vicinity of Hilo. Finally, we have, in the group of parasitic diseases an unfailing source of annual loss very difficult to guard against.

The most important work that will compel attention in the near future is the eradication of tuberculosis in the local dairy herds. This is a move demanded by the growth of population in the town of Hilo, the high proportional infant mortality, and the backward conditions which prevail in the milk supply business. In addition to the actual application of the tuberculin test a system of periodical inspection of dairy premises and animals should be inaugurated. It is to be hoped that during the ensuing year an ordinance will be obtained that will enable this work to be effectively done.

IMPORTATION OF LIVESTOCK.

During the period of 1911-1912 the following live stock were landed at the port of Hilo:—

	1911	1912
Horses	39	20
Mules	155	241
Cattle	47	0
Sheep	3	10
Goats	0	3
Dogs	2	0
Cats	0	1
Poultry (crates)	112	128

With a few exceptions the horses were draft or driving animals for the local market. The consignments of mules showed a marked improvement over previous years. They were principally composed of sound, young animals, large boned, running over 1100 lbs. in weight, and very well adapted for plantation work. In addition to those arriving here direct from California a larger number than usual were brought from Honolulu on inter-island steamers, having been purchased there for plantations on this island. All of the cattle were imported by local ranches for breeding purposes. The various consignments of livestock were landed in excellent health and condition, were entirely free from contagious diseases of any kind, and from those accidents which are liable to happen en route.

QUARANTINE FACILITIES AT THE PORT OF HILO.

In my previous reports reference has been made to the necessity of providing more extended accommodation at this port for the quarantining of imported animals in accordance with the rules and regulations of the Board of Agriculture and Forestry.

For this purpose a piece of land, four acres in area, owned by the Territory of Hawaii and formerly leased to the Waiakea Mill Company has been secured. This location is situated on the Volcano Road about one and a half miles from the Hilo post office, and is the most suitable of those available on the Waiakea side of the town.

Plans have been submitted for a quarantine station which meet in so far as possible, within the limits of the appropriation, the difficulties inseparable from a damp climate and incessant rains. They include one very large pen and two small ones, each equipped with spacious shelters; four boxstalls for stallions or valuable horses; two isolation stalls for the segregation of animals showing suspicious symptoms of contagious disease; and separate feed rooms for each consignment of livestock. A careful examination of the records for some years past shows that this is ample provision for average shipments to this port. It is hoped that work upon this station will commence at an early date.

CONTAGIOUS AND INFECTIOUS DISEASES.

GLANDERS.

It is gratifying to be able to report that this official district has been free from outbreaks of this disease during the whole of the period under review. As the last case was one detected in a stable in Hilo in the early part of the year 1909 this clean bill of health has endured for nearly four years.

A recrudescence of this disease in the Waipio Valley was suppressed by the Territorial Veterinarian during the latter part of this year, but fortunately there does not appear to be any reason to fear that there has been any spread of infection from this center. It seems probable that this is the last "nest" of this disease on this island, and it is hoped that the vigorous measures adopted on this occasion will result in the complete eradication of glanders on Hawaii.

TETANUS.

Whilst the writer has no desire to strike a note of alarm, the sudden and striking increase in the number of cases of tetanus or "lock jaw" in the neighborhood of Hilo compels emphatic notice. In my last report the rarity of cases of this description was mentioned as remarkable in view of the fact that the warm and humid climatic conditions in this part of Hawaii form an apparently ideal environment for the progagation and growth of the bacillus causing this disease. The Board of Health report for the year 1911 states that while in previous years tetanus was confined to Honolulu alone it has now spread to all the other islands. This is not entirely correct because one unmistakable case of this disease was seen by me in 1899 in a stable in this town, but my experience is corroborative in respect to the fact that the disease has increased to such an extent that it has now to be taken seriously into account by horse owners in this vicinity. The number of cases attended during the year amounted to seven, five in the town of Hilo, and two in the outlying district. These were, with one exception which recovered, all very acute cases resulting in death within twenty-four to forty-eight hours. In six of the cases entrance of infection was through a punctured wound in the foot; in the seventh there was no history of a previous wound. The actual number of cases is not particularly alarming in itself; the disquieting features in the situation are the sudden jump in number, the exceedingly favorable environment for further spread, and the fact that wounds of the feet from various causes are much more frequent here than in most parts of the world.

The bacillus of tetanus is ubitiquous, dwelling in moulds, soils, dust and animal manure. The ordinary methods of prophylaxis, therefore, relate to cleanliness in the stable. Periodical whitewashing, daily disposal of manure, and a manure pit sufficiently large to take care of it without overflow into the stable yard. Wounds of the feet should receive immediate attention, careful paring out, irrigation with antiseptics, and protective dressings to prevent entrance of dirt. Healing in wounds of the limbs or body, unless asepsis can be secured, is usually retarded by the application of bandages, but they should be thoroughly irrigated and covered with an antiseptic powder renewed as often as necessary.

The subcutaneous injection of tetanus anti-toxin is a very reliable preventive of the development of this disease and is used in badly infected districts before surgical operations are performed or after the infliction of accidental injuries. The expense of this treatment is only justified in the case of valuable animals or when the danger of infection is seriously feared. This stage has not yet been reached here, but if the ratio of increase continues in future years it is a measure that may have to be considered in badly infected stables.

EPIZOOTIC CEREBRO-SPINAL MENINGITIS.

The history of this disease upon the island of Hawaii is fortunately a very scanty one. The first outbreak of any consequence seen by the writer was in 1897 in which five animals died in a private stable in the Hilo district. During the following year six animals were lost from this cause within a very brief time by a plantation in the North Hilo district. In the Kau district more or less periodical visitations have been experienced for many years, although the number of animals affected at each time has been small. Towards the end of 1912 two outbreaks were attended, one in Kohala in which three animals, out of four affected, died, and another in Kau which resulted in the loss of four out of seven animals.

The difficulties encountered in attempting to assign a definite origin to these outbreaks is so very clearly illustrated by the circumstances upon one plantation that they will be briefly described. In the first place this is the only estate upon this island that has suffered from recurrent outbreaks extending over a long period of years. Although there are a number of stables upon the plantation, these outbreaks are confined to the one at the main camp. During a previous outbreak several years ago the old stables were torn down and fresh premises were erected upon a different site. These are good buildings, well situated and maintained in excellent sanitary condition. The pasture upon which the animals are turned out when working has only been in use for a few months. The supplies of imported feed, which consist of hay, barley and bran, are renewed every ten days, only a very small stock being kept on hand. During the continuance of the outbreak noted these replacements occurred three times. An examination of the food at the time of my visit showed that it was apparently of good quality and free from any objectionable features. The animals in the stable exhibited every appearance of proper care and intelligent management. The average number of deaths in these outbreaks has been about three, and so far as can be learned neither age, sex, nor previous state of health have been factors in the production of either immunity or predisposition toward the disease. Under these circumstances the utmost that can be conjectured is that the cause is localized in the immediate neighborhood; that, if it due to forage poisoning the toxic agent is contained in native green forage rather than in the imported feed; and that, if of bacterial origin, the casual agent is stimulated at certain times to pernicious activity by unknown local conditions, or belongs to a ubiquitous species which has acquired a favorable environment in this vicinity.

The causation and pathology of this disease are very imperfectly understood at the present time, and there is reason to believe that the designation of epizootic cerebro-spinal meningitis covers a variety of allied diseases characterized by similar clinical phenomena but caused by toxic agents of different origin acting injuriously upon the central nervous system. From the evidence that has accumulated in recent years one class is undoubtedly found in mould fungi present in the food, and, in an examination into the causes of an outbreak the slightest evidence of deterioration of foodstuffs is sufficient to justify destruction of the supply on hand. Under any circumstances in view of the fact that such moulds may be present in a dried or powdered form and, therefore, difficult to detect by the senses of sight or smell it is desirable to make as complete a change in this respect as possible. In many instances, however, the hypothesis of forage poisoning is impossible of demonstration or apparently confuted by the conditions of occurrence.

In addition to disinfection of premises and change of feed, affected animals should be placed at once in slings unless paralysis is already so advanced that they are unable to maintain themselves upon their feet. Sudden relapses may occur at any time in animals that appear to be progressing favorably, and for this reason it is advisable to keep the patient in slings for three or four weeks. When recovery is sufficiently far advanced, walking exercise should be given during the day. The theory of food poisoning suggests the use of such drastic cathartics as eserin and arecolin given in hypodermatic injections at the commencement of the attack. In the later stages nerve stimulants in small repeated doses can be safely employed. Deglutition is usually impaired by partial or complete paralysis of the muscles governing this act and all medicines administered should be given subcutaneously rather than by the mouth on account of the danger of mechanical pneumonia.

ENDEMIC CATARRHAL FEVER.

With the exception of one severe outbreak in the early part of last year affecting twenty-five animals in a plantation stable, this disease has manifested itself in scattered cases usually of a mild type. In the outbreak referred to, the "pneumonia type," the most dangerous form of this protean disease, predominated, and the majority of the animals affected were mules. The conditions were favorable for a very heavy mortality and undoubtedly this would have happened if those in charge of the stable had not adopted proper precautions. In view of the fact that this disease has been more or less prevalent on this island since 1908 it is advisable again to call attention to the measures which should be taken when this disease makes its appearance in a stable in which many animals are confined. The prophylaxis is very simple, but it demands the exercise of unceasing vigilance on the part of those responsible for the animals. The essentials are:—prompt detection of each case as it arises; immediate isolation; and periodical disinfection of the premises. The first reliable symptom is a rise of the body temperature from normal to 102° or more, which can only be discovered by the free use of the clinical thermometer. This operation can be performed by any person of ordinary intelligence and should be applied to every animal which shows any suspicious symptom. A more certain measure, but one that is not always practicable, is to take the temperature of every animal in the stable during the prevalence of an outbreak. This is an effectual safeguard against a large percentage of loss because the majority of fatal cases are caused by working the animals after the disease has become established in the system; and, also, it enables earlier isolation which is undoubtedly advantageous. Each fresh case constitutes a center of infection in the stable; it should, therefore, be removed to some other location and fed and watered by itself. The stable premises should be periodically whitewashed with lime added to a 5% solution of creolin, and the floors saturated every three or four days with the creolin solution.

The only therapeutic treatment necessary in mild cases of the disease is rest and laxative food. If there is marked irritation of the throat with painful, racking spasms of coughing, two ounce doses of glyco-heroin diluted with an equal amount of water given two or three times daily will be found beneficial. High fever, inappetence, profound lassitude, rapid respirations, and acceleration of the pulse usually denote extension to the lungs and pleurae. For this condition the use of strepticoccic vaccine and nuclein has given better results in this practice than the older methods of treatment. Under any circumstances the copious drenchings with stimulants and febrifuges which were formerly in vogue should be avoided. They are attended with much risk to the patient and their usefulness in a specific disease of this nature is very doubtful.

TUBERCULOSIS.

Although the percentage of tuberculous cattle in this district is probably much less than that revealed by the use of the tuberculin test on Oahu occasional cases are noted among dairy cattle. The native ranch-bred animals appear to be singularly free from this disease, and most of the cases detected are in animals imported previous to the enforcement of the present regulations, their offspring, or in-contact animals. Two herds, numbering in each about twenty animals, successfully passed the test.

Some improvement in the milk supply has been effected by a Board of Health ordinance compelling cow-keepers to maintain their premises in a sanitary condition, and to make necessary improvements in their buildings to render this possible. The next step to be desired is the issuance of an ordinance by the proper authority which will allow a system of periodical inspection and testing to be established.

PARASITIC DISEASES.

Liver Fluke in Cattle.

The occurrence of this parasite has been very rarely noted on the windward side of this island. During this period two cases from the same herd of dairy cows have been at the local slaughter house. This discovery acquires some importance from the fact that attempts are being made to extend the dairying business in the upper Olaa district and place it on a profitable basis. This is a wet district with rainsoaked pastures covered with rank, lush vegetation and appears to be an exceptionally favorable environment for the development of this parasite. It may be suggested that on account of these conditions it will be a very wise precaution in importing animals into this area to purchase them only in localities which are not infected with liver fluke.

Heart Worm in Dogs.

This is, also, a comparatively rare affection in this district, only four cases having been seen. Two of them were noted during the past twelve months in dogs said to have been brought here from Oahu.

EXTRACT FROM ANNUAL REPORT OF THE PRESIDENT OF THE BOARD OF TRADE OF HILO FOR THE YEAR 1912.*

Public Health and Sanitation.

"A contract has been let, and construction has commenced upon a building for the offices and pathological laboratory of the Board of Health. Under the able supervision of Chief Inspector D. S. Bowman sanitary conditions in the town and upon the plantations are being steadily improved, the community enjoys freedom from serious outbreaks of endemic disease, and in these respects favorable comparisons can be made with similar communities on the mainland.

"A glance at the vital statistics contained in the last report of the Territorial Board of Health reveals that out of a total of 3296 deaths in this Territory 1042 occurred among infants under twelve months of age, and that for this county the figures were 858 and 300 respectively. These figures acquire startling significance when subjected to analysis and compared with others. Reduced to their simplest terms we find that two out of every eight children born on this island are doomed to the grave within twelve months, to be followed by one more in less than five years. This means an infant mortality of 240 to each 1000 births, and a combined infant and child mortality of 360 per 1000. Authorities who have carefully studied this subject in England believe that by improving conditions in that country about 40 deaths to each 1000 births should be about a normal ratio. The actual figures at the beginning of this century were a proportion of 163, which has since been reduced to 109 by the introduction of very partial and incomplete measures of reform. Even if we allow liberally for incompleteness of birth returns, and possibilities of error in comparison, these facts should make us pause and think. When we reflect upon the fearful handicap of infantile environment in the crowded and poverty-stricken slum areas of London and the great manufacturing centers of England, we are forced to ask ourselves if some remedy cannot be found for this apparent wastage of human life on Hawaii? Apart from those humanitarian considerations which should profoundly influence our action, the conservation of human life has its monetary value equally with that of all other natural resources. We will need fewer immigrant ships from the ports of Southern Europe in days to come if we can do something now to minimise this irreparable drain upon our future citizenship.

---

* Dr. Elliot has been for the past two years President of the Board of Trade of Hilo and I take pleasure in appending this part of his annual report as bearing directly upon his work as Deputy Territorial Veterinarian.—V. A. N.

"What can we as an organization do to help in the fight for the lives of these little ones? We can do our share in creating a strong, healthy public opinion that will call for careful, scientific investigation into the causes of this mortality, and which will stand solidly behind all rational proposals for its prevention. Parental ignorance, probably the principal cause, must be attacked by a systematic campaign of education through the medium of district nurses and distribution of literature. It is hardly necessary at this date to insist upon the importance to every community of a supply of pure, wholesome milk free from filth and disease germs. Some amelioration in the local situation has been made by the issuance of an ordinance enforcing improvements in buildings and the sanitary condition of premises. This is a move forward, but much remains still to be done. The Board of Agriculture and Forestry are anxious to extend the excellent work that has been done in Honolulu to the other islands, and I hope that it will be possible to lay before you a definite, practical scheme of dairy licensing and inspection that will ensure sanitary premises, healthy animals, clean utensils, cleanly methods of handling and marketing, and purity and wholesomeness of the product itself. Your attention and support are particularly invited to this measure because the passage of an ordinance by the County Board of Supervisors will be required to make it effective."

Report of the Deputy Territorial Veterinarian for the Maui District.

By

J. C. FITZGERALD, M. R. C. V. S. (London),

STOCK BREEDING.

Conditions have so changed within the past fifteen years, from a stock breeding standpoint, in the Territory that the entire industry has been, to some extent, reorganized, and the class of animals being bred show considerable improvement; but a much more thorough reorganization is necessary to supply adequately the constantly increasing demands of the country both in quality and quantity, and at the same time endeavor to produce a standard of equality with the products of other progressive countries. These changes have been necessitated by the fencing of land, the increased value of ranch lands, etc. With these conditions the importance of improving the class of stock on the range lands is apparent, as in the old days of open ranges, almost any class of animal could be raised profitably, but today, high grade, quickly maturing cattle that will dress a good percentage of beef when slaughtered, and the best class of horses are a necessity as the increased value of ranch lands will not permit the raising of scrub stock with any margin of profit.

The universal and steady progression of the country is such that the constantly increasing demand for something better should in itself be an incentive to the stock raisers to keep abreast of the times. The plantations are using better class animals as a general run than they have heretofore, and are bestowing much more care upon them. The Cavalry and Artillery Regiments of the United States stationed on Oahu create a steady demand for high class remounts and artillery horses. The increasing demand for polo ponies with breeding and speed is also a factor; lastly, the renewed interest in racing is a source from which to draw a goodly profit, if the right kind of animal is forthcoming. Taking all in all, the encouragement to the breeders to invest in high class breeding stock was never greater that at the present time. It was feared that the innovation of the automobile would cripple the horsebreeding industry, but the reverse has proved to be the case, and horseflesh is higher in the Islands today than ever before and the demand for high class animals has increased.

During the past few years many importations of pure bred stock have been made; principally bulls and stallions. These have made their influence on the island stock apparent, but this process of improvement is all too slow, as can be seen when comparison is made between ranches that have imported both sexes, and those that have confined their importations to males. It has been frequently demonstrated in horse breeding, especially in thoroughbreds, as among these, better facilities are offered for testing the results of breeding, that sixty per cent. lies in the dam. The breeding operations of many of the most successful breeders of America and Great Britain have been conducted on these lines with no meagre results. It is to be hoped that the importations of the future will include more females, and that breeders will see the common sense of this policy; economy of time being one of the chief factors in modern progress.

Two very noteworthy importations of horses and mares for breeding purposes have been made to this Island during the past biennial period. One of some forty grade Percheron mares all bred to a purebred Percheron stallion, was accompanied by two registered Percheron stallions. These were imported by Mr. L. von Tempsky of the Haleakala Ranch as neucleus for a band of draught horses from which the Plantations may be supplied. The mares in this consignment are a nice level lot of active young animals and both stallions are of good bone and quality and should prove a valuable asset to this Ranch.

The second consignment of note was thoroughbred stock and consisted of a stallion, four mares and four yearlings. These animals were purchased by Mr. H. A. Baldwin with a view of improving the class of animals used for saddle purposes, and breeding stallions to be distributed on the different ranches.

"Sileo," a seal brown stallion, 16.3 hands, weighing 1250 lbs., with over 8½ inch bone below the knee and is undoubtedly the largest and best bred animal in his class ever brought to the Hawaiian Islands; as he can claim the double honor of having won good races, which proves his stamina; and of also having won in the show ring, which is a testimonial to his conformation and carriage. Notwithstanding the fact that this animal has such size and bone, he is active, absolutely sound, very gentle and level headed. His breeding cannot be overlooked, being a grandson of "St. Simon" who was the leading sire of Great Britain and the most successful sire in the world. He is equally well-bred on his dam's side. Taking these necessary points in a high class stallion into consideration, there is every reason to believe that this animal will prove a profitable investment from a horse improvement standpoint.

"Delagoa," bay mare, 15.2 hands, 1050 lbs. By "Kingston-Rhodesia," is a typical brood mare, bred by the late James K. Keene.

Bay weanling colt, by "Von Tromp" out of "Delagoa." This colt was born on Maui on March 24, 1912.

"*Northwest,*" bay mare, 15.3 hands, 1100 lbs., by "Montana" ex "Nina M." This is a mare of good quality and should drop some good colts.

Black filly, by "Deutschland" ex "Northwest," born April 13, 1912.

"*Lady Toddington,*" bay mare, 16.2 hands, 1200 lbs., by "Toddington" ex "Merry Heart." This mare has an exceptional amount of bone.

Brown filly, by "Von Tromp" ex "Lady Toddington;" born March 11, 1912. This filly has exceptionally good bone and size.

"*Good Cheer,*" ch. mare, 16.1 hands, by "Fonso" ex "Harpy," 1150 lbs., bred to "Sileo."

A bay colt (stallion), by "Sileo." A bay filly by "Sileo."

These animals are about twenty months old.

The above mares are all in foal to "Sileo." He has, in addition, been bred to fifteen half bred mares.

The value of this importation, with proper handling, is unquestionable and it is to be hoped that other breeders will follow the good example and make importations of thoroughbred stock, while the American market for them is such that they can be purchased for about half their real value, owing to legislation prohibiting racing in the major portion of the United States. Many adverse criticisms have been made and are frequently heard in reference to thoroughbred blood, but it is the only source from which any real improvement to saddle stock can be reasonably looked for. This is clearly demonstrated by the breeding methods adopted by the Governments of the powers of the world in the breeding of remounts. In citing a few instances where most costly thoroughbred stallions are being used for this purpose, mention may be made of the acquisition of "Henry of Navarre," "Octagon," "Footprint" and "Tipsand," by the United States Breeding Bureau. These animals were presented to the nation by Mr. August Belmont, who, as a breeder of world-wide fame, could see the necessity of strengthening the country's defences, through building up the standard of the remount. The purchase by the German Government of "Galtee More," one of England's great thoroughbreds, for $100,000, is also another instance.

It has been frequently stated that the progeny of imported animals deteriorate in the Hawaiian Islands, and it was only the other day that the writer received a letter from a prominent breeder of dairy cattle, in answer to one of inquiry with a view to purchasing some cows and bulls, in which he stated that as he had made importations to the Islands on many occasions previously,

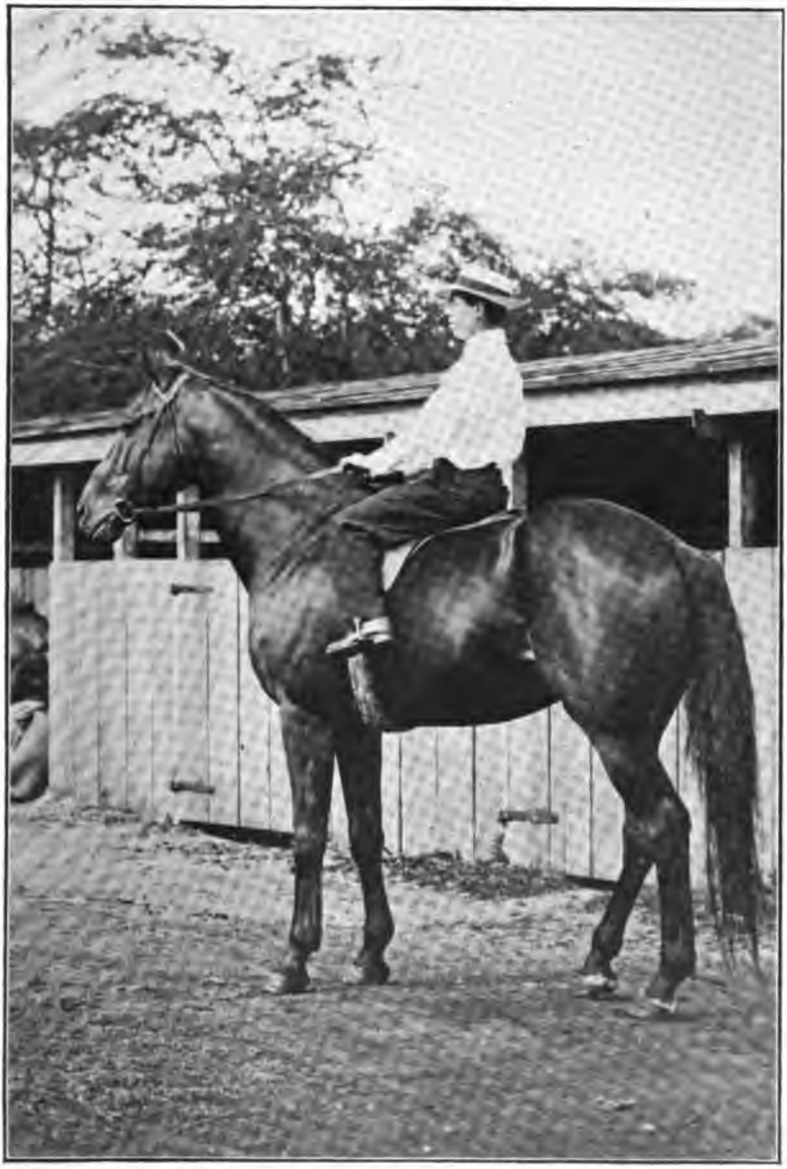


Plate 30. **Sileo. Thoroughbred Stallion.**

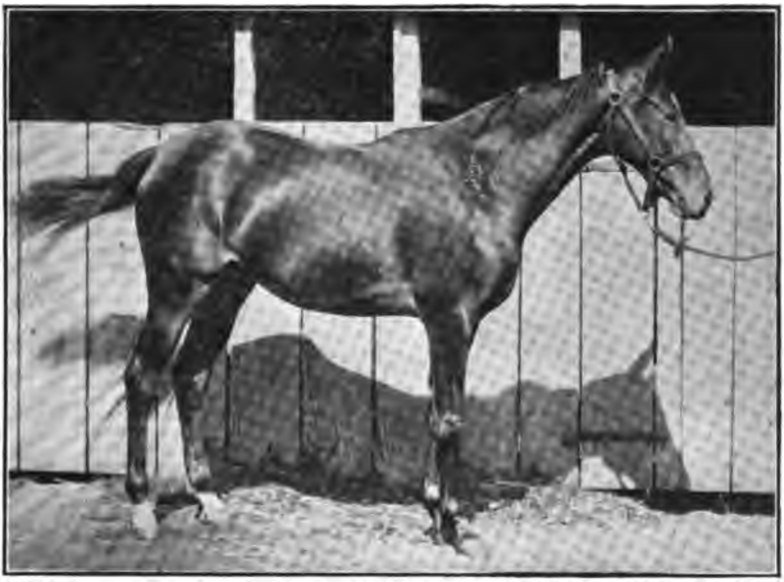


Plate 31. Fig. 1. **Bay Filly, by Sileo ex Divina.**
20 months old. Height 15.1½.

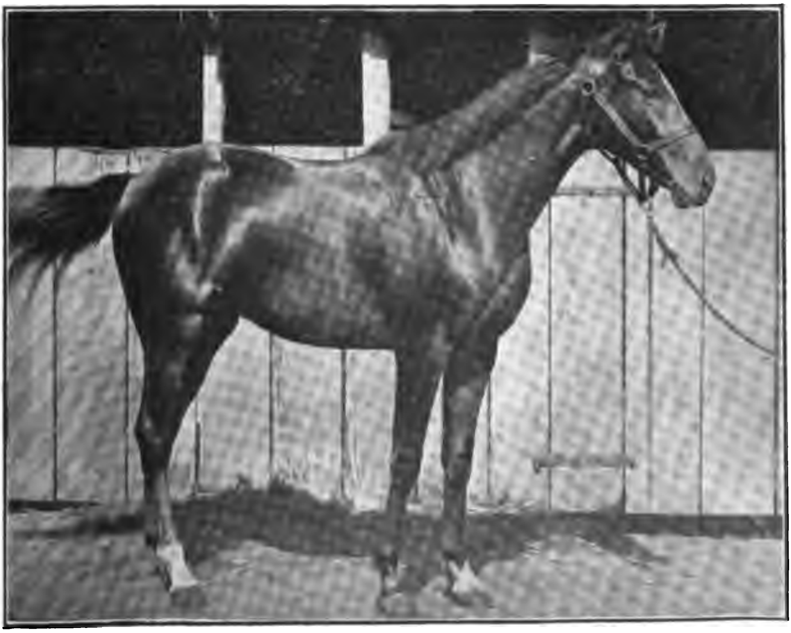


Plate 31. Fig. 2. **Bay Colt, by Sileo ex Dorelike.**
20 months old. Height 15.1½.

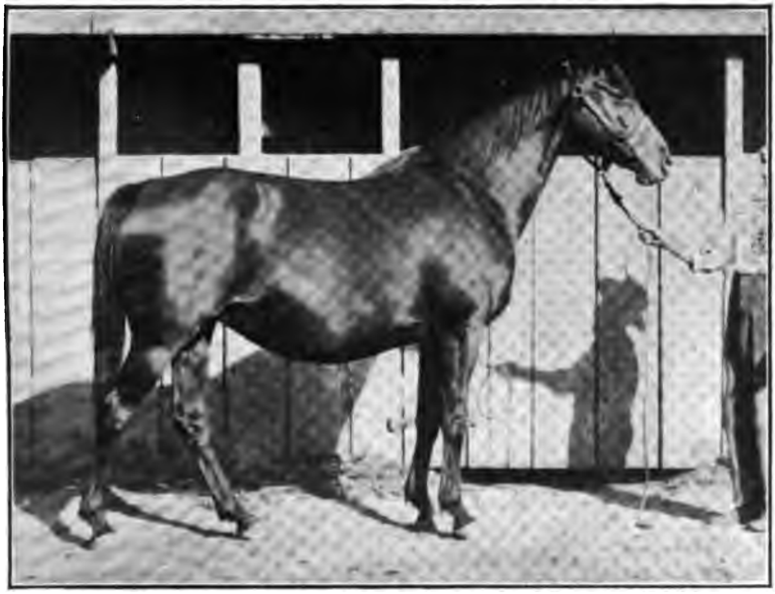


Plate 32. Fig. 1. **Delagoa. Bay Mare by Kingston ex Rhodesia.** A typical brood mare, of exceptional quality.

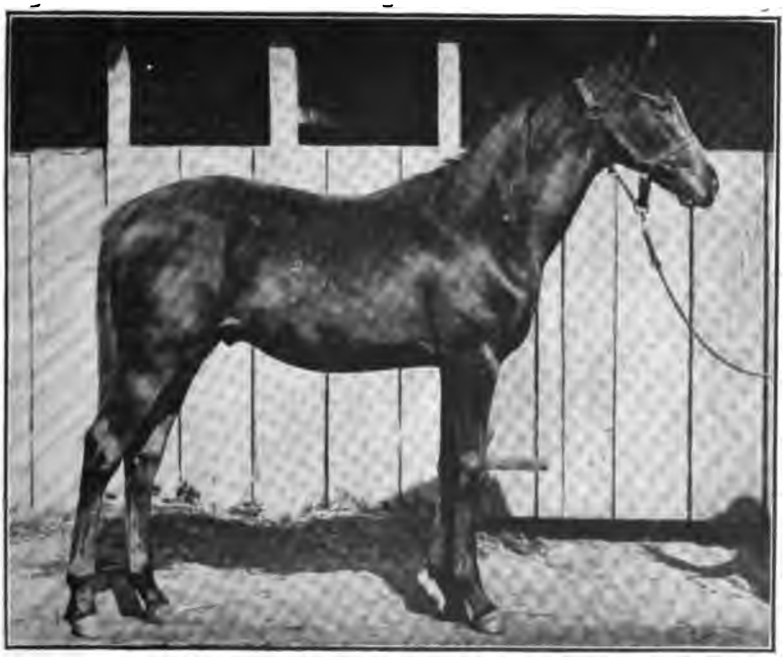


Plate 32. Fig. 2. **Delagoa's Colt by Von Tromp.** Born March 24, 1912. Height 14.½. This animal is of exceptionally good quality and conformation.

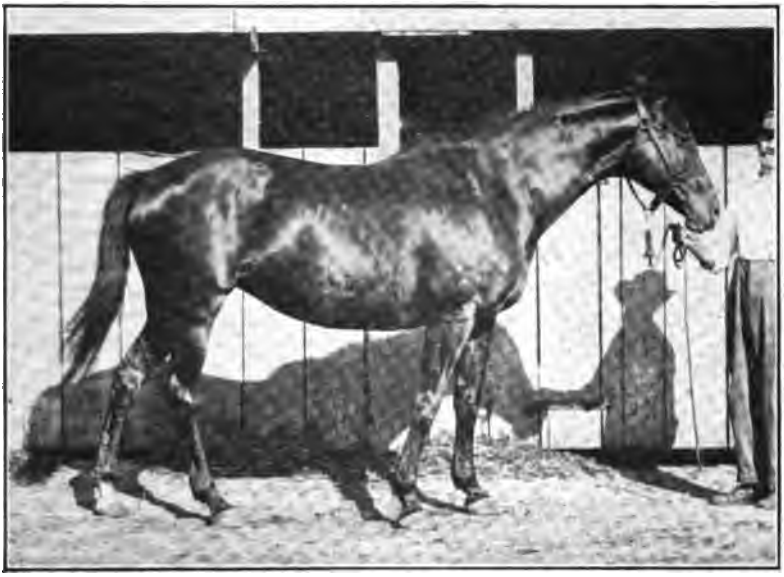


Plate 33. Fig. 1. **Northwest, by Montana ex Nina M.**
A mare of excellent type and quality.

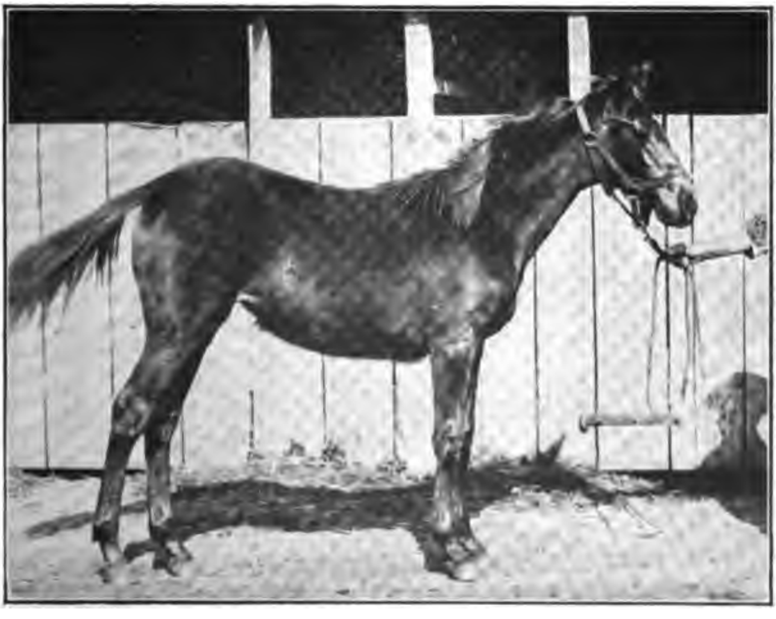


Plate 33. Fig. 2. **Northwest's Filly by Bearcatcher.**
Born April 13, 1912. Age, nine months.

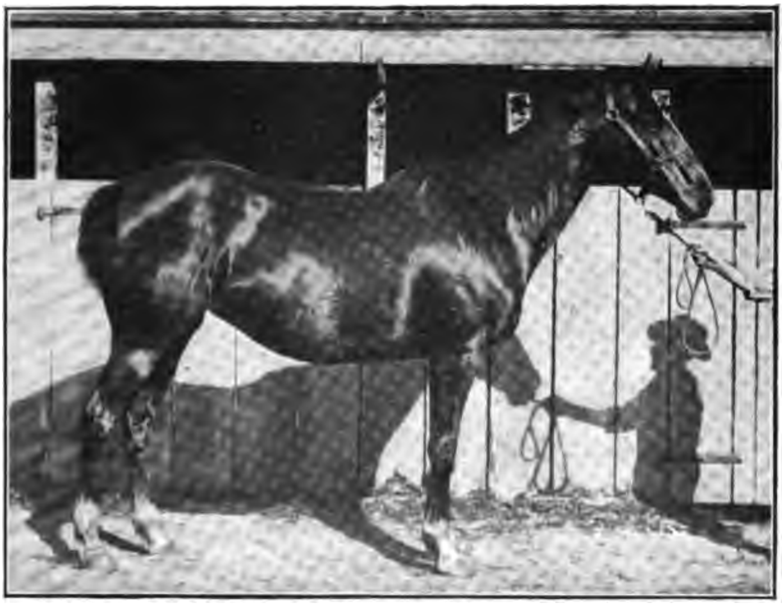


Plate 34. Fig. 1. **Lady Toddington by Imp. Toddington ex Merry. Heart by Sir Modred.**

This mare is of English and Australian blood and possesses exceptional bone and size.

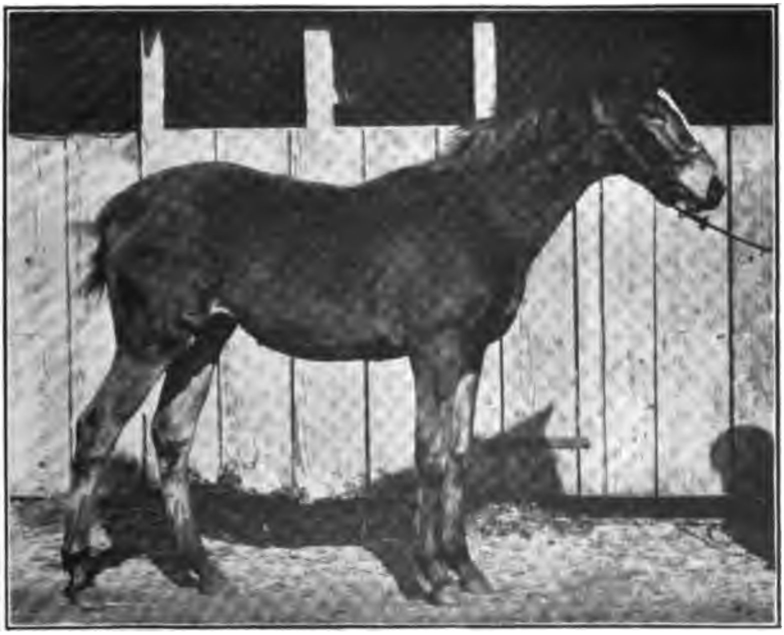


Plate 34. Fig. 2. **Brown Filly by Von Tromp ex Lady Toddington.**
A filly of exceptionally large bone.

and that as the animals had deteriorated to such an extent after arriving here, they came nowhere near his description and he would prefer to refrain from making any further sales to the Islands, as they conferred no credit upon him or his stock. This instance is quoted more in the nature of a query, viz: Is the climate responsible or is it the feed? The latter would, I think, be the safest solution and also the most easily remedied. The cultivation of alfalfa and other feed stuffs when more general, will undoubtedly eliminate much of this so-called degeneration. From experiments, made by the writer through the courtesy of Mr. H. A. Baldwin and Mr. F. F. Baldwin, in the feeding and raising of young stock, he is confirmed in the opinion that with proper care and feeding, (even less than is necessary in other countries) colts can be raised here with the same bone, and substance, as in any other country, provided the natural deficiences of the country are supplied artificially, viz:—bonemeal and substituting alfalfa for manienie grass in part. From the illustrations it will be seen that these colts, experimentally raised, show neither lack of bone or size, and compare favorably with animals of their age raised anywhere. Having had the necessary conditions to acquire a good growth during their infancy, they can better face the vicissitudes of droughts, etc. without any possibility of becoming stunted. This is a point which has been neglected to such an extent that even with good stock to breed from, many of the progeny are puny and stunted; whereas, if they had been given the necessary care at the most critical period of their lives, when weaned from the mares, the chances of stunting their growth would be greatly minimized.

The writer would urge upon the breeders in the Territory the necessity of raising feed crops; the feeding of brood mares and colts up to the time they are yearlings; the importation of high class stock, especially females; and at the same time offering every possible encouragement to the small breeder to improve his stock. In most of the large horse breeding countries, it is frequently due to the efforts of the small breeder that many of the highest class animals are raised. An instance of this method for the betterment of horse breeding may be quoted from this island. A well bred stallion of good bone and quality has been stationed in the Makawao district by the courtesy of Mr. H. A. Baldwin. This animal will be bred to a number of approved mares free and should prove a valuable addition to the district.

A factor that would prove a valuable stimulus to stock breeding in the Islands would be the inauguration of an agricultural show on each Island. It is to be hoped that at some time in the near future steps may be taken in this direction. There is no influence so beneficial to the animal husbandry of a country as the competition provided by agricultural shows, racing, polo and horses sports generally.

DISEASES OF LIVE STOCK.

TETANUS.

The number of cases of Tetanus (lock-jaw) within the past biennial period have been just double that of the previous two years; eight cases having been treated. Of this number, two have died, the remaining six recovering. These animals have all been treated with Antitetanic Serum in 12,000 unit doses every six hours until the tetanic spasms abated; afterwards diminishing the dose gradually to 3,000 and lengthening the time between each injection. In addition to this, Epsom Salts 4 oz. was given in the drinking water twice daily and in one case, where the hyperesthesia was such that death from exhaustion was feared, hypodermic injections of morphine, 2 gr., were given as frequently as was consistent. Cold enemata are sometimes beneficial.

This brings the record of tetanus cases on the Island of Maui for the four years, to twelve cases treated with antitetanic serum, three of which died.

CEREBRO SPINAL MENINGITIS.

Cerebro Spinal Meningitis is undoubtedly responsible for more deaths among horse stock than any other disease occurring in the Hawaiian Islands. It is by no means a new disease, having been known to exist on Maui for thirty years or more, but was not definitely diagnosed as such until recent years; it appears to have existed principally in the Kahikinui and Kaupo districts on Maui. and also in North Kohala, Hawaii. At the present time it is of much more frequent occurrence in the sugar growing districts: this may be to some extent due to the geographical changes that have taken place on this island.

The mortality from Cerebro Spinal Meningitis has been heavier during the past two years, than in 1909 and 1910; this may be attributed partly to the droughts and unsteady rainfall. as a predisposing cause: but there is no doubt that it is steadily on the increase, as will be shown by the following figures; cases of an epizootic nature are not recorded:

1909-1910	Outbreaks 5	Deaths 15
1911-1912	Outbreaks 10	Deaths 35

A feature of some interest that has come under the writer's observation in connection with this disease is, that in cases occurring subsequent to the first rains succeeding a protracted drought, the toxin producing organisms appears to have greater virulence, and that after the rainfall becomes steady the disease assumes a much milder form, and gradually dies out.

The actual cause of Cerebro Spinal Meningitis is unfortunately not definitely known; many theories have been advanced as to the cause, and predisposing causes; some writers attributing it to the feeding of unsound grain of poor quality; this theory probably originated from the similarity in many of its symptoms to "Pellagra" (a disease of humans, prevalent among the peasantry of countries in which the staple diet is one of cereals, and caused by eating grain of inferior quality).

Other writers on the subject consider its cause to emanate from the feeding of mouldy grain, and have described it under the heading of "Forage Poisoning." This theory is undoubtedly correct in many outbreaks but cannot be considered general as applied to the Hawaiian Islands. As many cases occur and have been reported among pastured and range stock that were not fed grain, as was undoubtedly the case in those described by old residents as having occurred on the ranches years ago. On the other hand, the stables in which the largest and most serious outbreaks have occurred (The Maui Agricultural Co.) are under the supervision of a careful and practical horseman, whose vigilence is such in connection with mouldy food stuffs, that it would seem improbable that sufficient to cause outbreaks of the magnitude experienced, could escape his notice ;again, it does not seem feasible that climatic conditions should play so important a part in its origin and that they and Cerebro Spinal Meningitis should work so consistently hand in hand, if the cause of this disease is to be ascribed solely to imported feed stuffs. Taking all these things into consideration, and also from observations made, the writer is of the opinion that the chief danger lies in the drinking water acting as vehicle, and conveying the moulds washed by the surface waters from the grasses to the drinking troughs. This was suggested by the Territorial Veterinarian during his last visit to an outbreak of Cerebro Spinal Meningitis on this island. Attempts have been made to substantiate this opinion, by filtration of the drinking water in stables, but so far it has not been possible to do so in a manner that would prove of any value, as filters of adequate capacity could not be procured; these have, however, been ordered from the east.

Cerebro Spinal Meningitis is a disease affecting the nervous system, particularly of horse stock, but also affects cattle and sheep. The symptoms are so varied in different animals affected and commensurate with the acuteness of the attack that it can better be described by dividing it into three classes:—acute, subacute and mild.

Acute.

Animals are attacked with the acute form of this disease so suddenly that there are usually no premonitory symptoms, and death may occur in a few hours, or they may last two or three days; some fall while at work in the field, others are found dead in the stable in the morning, although appearing apparently in good health the night previous. In some cases, however, a staggering gait may be noticed previous to the animal falling down. Paralysis of the muscles of the hind legs, tail, and throat quickly present themselves, the latter causing inability to swallow; the facial muscles in some cases are so affected as to draw up the corners of the mouth, giving the animal a weird and haggard expression. Hyperesthesia is usually present, and the pupils are dilated; the breathing is stertorous with a well-marked diaphragmatic line, due to muscular contractions, and is frequently accompanied by a rattling in the throat, due to the muscular paralysis; the pulse in the initial stages of the attack may be almost normal, but becomes weaker and weaker until it is imperceptible; as the disease advances periodic convulsions occur, with frequently oposthotonous or episthotonous contractions, which rapidly become more frequent, the animal frequently succumbing to one of these convulsions, or in other instances passing on to coma and subsequent death. Almost 100% are fatal.

Subacute.

This is by far the most common form of the disease; it is ushered in by a staggering gait; awkard manner of standing, with the hind leg tucked under the body, as in founder; some show colicky symptoms which are very misleading; in some cases paralysis (partial) will not come on for two to four days; there is usually a listless almost foolish expression with slightly dilated pupils. The later symptoms are, inability to rise when lying down, but at first if put in slings they appear normal and usually eat and drink well in the milder cases; in the more severe cases paralysis of the muscles of deglutition may be noticed by the difficulty evinced in swallowing water, saliva drools from the mouth; the animal is usually extremely thirsty and will make constant attempts to drink if given water, and even if unable to swallow will keep playing with it constantly; but if food is offered they will usually hold it in the mouth, making no attempts at mastication, and in the event of their doing so, the attempt is one of the most striking forms of lack of coordination of movement. The bowels are usually sluggish in action, faeces mucous coated, and the urine scant and often retained, owing to paralysis of the muscular wall of the bladder. In this disease if the animal is put in slings it may appear to be doing well for a few days or a week and then may be seized with paralysis, and unable to stand. This is quickly followed by convulsions and death ensues rapidly, the unfortunate animal's last few hours being spent in a sequence of convulsions, rigors, and cold sweats. The temperature may be anything from 99.8 to 106 and is no guide whatever. If the paralysis of the throat lasts two or three days and the animal survives, during the attempts made to swallow, particles of food will become lodged in the trachea and upper nares, causing a profuse and offensive discharge from both nostrils. Some cases prove fatal as a result of this mechanical cause. In the subacute form about 50% to 60% prove fatal.

Mild.

This is the very mildest form of the disease and in some cases may be noticed simply by the fact that the animal is off its feed for a few days. In the more severe cases, there is a slight lack of co-ordination of movement in the muscles of the hind legs and when lying down, the patient may not be able to rise without some assistance. Very few cases of this class prove fatal but the recovery is slow and even though apparently well, the animal will be sluggish for a considerable period after the actual recovery is complete.

Post-Mortem Examination.

The post-mortem appearances in Cerebro-Spinal Meningitis are almost as unsatisfactory as the treatment and without the history of the case, in some instances, it would be almost impossible to make a diagnosis from a post-mortem examination.

The cerebral membranes are usually congested with more or less serious effusion in the cranial cavity. The mucous membranes of the pharynx, trachea and upper nares are frequently intensely congested which is consequent to the mechanical effects of paralysis of the throat. Petechiae are sometimes seen on the septum with a mucous discharge from both nostrils. Very infrequently the kidneys are congested but this is by no means common and in the average case, the organs of the body appear perfectly normal.

Immunity.

One attack of Cerebro Spinal Meningitis does not confer any immunity. Many animals have been affected twice to the writer's knowledge and two animals, the property of the Maui Agricultural Company, were affected three times. One of these animals died as a result of the third attack. Nor does age or condition confer immunity.

Susceptibility.

The susceptibility of the different animals to this disease undoubtedly varies considerably in the different countries in which it is prevalent as seen by the reports from the recent outbreaks in Arkansas and Kentucky, which state that bovines are highly susceptible. Such is certainly not the case in the Hawaiian Islands, only two cases in cattle having come before the writer's notice. A large outbreak occurred among the sheep on the Island of Lanai two years ago. This is the only one so far recorded among ruminants. The table of susceptibility as applied to the Territory of Hawaii, would therefore be mules first, horses second, sheep third and cattle fourth.

Treatment.

Almost every treatment imaginable has been tried with little or no success. The most efficacious remedy appears to be the early administration of a rapid purgative agent, such as oils, salts or Eserine; the latter is preferable as it is not only more rapid in its action, but can also be given hypodermically, thus eliminating the necessity of drenching the animal, which is extremely dangerous when there is any paralysis of the muscles of deglutition. It is therefore wise to confine all medicinal treatment to the range of the hypodermic syringe. Atropine may relieve the paralysis of the throat and heart, stimulants are in some instances indicated, but taken all in all medicinal treatment is of little avail.

The writer has experimentally attempted bleeding with infusion of normal salt solution. Sea water, both subcutaneously and by the drop method, sedatives and stimulants have also been used but in each instance without satisfactory results. After the bleeding experiments, which were followed by normal salt infusion, it was expected that enough of the toxins would be removed to show some abatement in symptoms. This did not prove to be the case, however, which would probably indicate that the toxins are in the nervous system, as in tetanus, and not in the blood stream.

The preventive treatment will prove the most beneficial in the long run and I would strongly advise that all drinking water from a surface source be filtered, and that careful attention be given to all food stuffs and a watch be kept for any trace of mouldy or musty grain.

In any case under treatment with paralysis of the throat, it is a very wise precaution to keep food and water away from the animal as long as is consistent, or until these symptoms abate, for in the event of this not being done, a mechanical Bronchitis is almost always inevitable. In all cases rely principally on purgatives and careful nursing and give any medicines administered, hypodermically.

STABLE MANAGEMENT.

Many improvements have been made in the economics of the stables on the plantations and ranches both as time-savers and for the provision of additional comfort for the animals. Most worthy of note among these is the employment on two of the largest plantations of stable superintendents, whose duties include the management, feeding, fitting of harness and attention to the general hygiene of the stables. The result of this innovation is that each animal is provided with its own harness and a collar which actually fits. All animals are sponged over and collars thoroughly cleaned after the day's work. With these precautions the collar sore is fast becoming a rare sight. Apart from the additional care given to the animals, the stable superintendent has charge of the issuing of new harness and is the means of saving a considerable amount of broken harness, which would otherwise be thrown away by the teamsters. The assistance which the superintendent is able to give the attending veterinarian is also of great value.

Electric power and light have been installed in the main stables and ere long electric clipping and brushing machines will be used. These will economize considerably in stable labor.

The Hawaiian Commercial and Sugar Company has erected on their ranch at Spreckelsville a thoroughly up-to-date breeding plant, with loose boxes and yards for the Stallions and Jack, a range of good, airy loose boxes, with the necessary wash-rack, feed rooms and corrals for brood mares and colts. And a man with life-long breeding experience has been placed in charge of this department by Mr. B. Williams, the Ranch Manager.

Many valuable experiments have been made in the feeding of plantation stock with dessicated blood, molasses, brewers' grains and various other foodstuffs by Mr. Williams of the Hawaiian Commercial & Sugar Company. The substitution of these foods for barley and oats has proved a considerable saving in live stock expenses.

GLANDERS AND EPIZOOTIC LYMPHANGITIS.

These diseases were so prevalent in the Hawaiian Islands generally and more especially on the Island of Maui where they were found to exist to an alarming proportion for the first two years after the inauguration of a Deputy Territorial Veterinarian's office, that it was at that time feared that their eradication would be a matter of a good many years' work. Thanks, how ever, to the public spirited manner in which the plantations of this Island have given their assistance to the Veterinarian and to the Sheriff and County officials, who have given their aid in every possible manner, these diseases have been so successfully combated that during the past two years the writer is able to report, that as far as he is aware, there has not been a single case.

Many suspicious cases have, however, been reported but in nearly every instance these animals were found to be suffering from catarrhal fever; one from gangrene of the lungs and another with a neglected case of Cerebro-Spinal Meningitis with a nasal discharge. The writer simply quotes these cases illustrative of how readily any animal showing a discharge from the nose is reported to this office and it is also a great satisfaction to know that in most instances the report is turned in by the owners themselves.

Strict supervision of all stables, with attention to drinking troughs, etc. is still maintained and whenever possible, all animals coming from the other Islands are inspected as a precautionary method.

With the stringent laws governing the importation of horse stock, which make it almost impossible for any affected animal to be brought into the Territory, combined with the work of the Veterinary Department of the Board of Agriculture and Forestry, it should be but a few years when Glanders and Epizootic Lymphagitis will be completely eradicated from the Territory. The most marked argument in favor of this assertion is the fact that practically the only outbreak of Glanders within the past year, is the one reported by the Territorial Veterinarian as occurring at Waipio Valley in the Hamakua District of Hawaii. It will be remembered that this is the only district in the Territory where the Veterinary staff of the Board of Agriculture and Forestry is not represented.

TUBERCULOSIS.

There is no one disease represented on the Island of Maui that is so much in need of work for its eradication as bovine tuberculosis. From the more recent tuberculin tests made, it appears to be on the increase.

Numbers of tests have been made periodically in both dairy herds and among private cattle, at the request of the owners, and although this type of testing and eliminating the reactors does some good, no real or lasting good can possibly be hoped for until the matter is taken up in a methodical manner, with a proper and efficient milk ordinance and an adequate sum of money to carry on a proper anti-tuberculosis campaign.

A milk ordinance is under consideration by the Board of Supervisors at the present time and there is every reason to suppose that one will be passed and an appropriation made to cover the salaries of Milk Inspectors and traveling expenses. These measures have been recommended to the Board of Supervisors by a representative committee of cattle owners, who were chosen to represent the Dairy and Ranch interests for this Island. A meeting was held on Monday, January 6, 1913, in Kahului, for the purpose of discussing and amending the proposed Milk Ordinance, which is similar to the one in force on Oahu, so that it would meet conditions on Maui. The dairy industry being so widely spread over the whole Island, it was considered best to have an Ordinance that would not prove a hardship to the small dairymen thus putting them out of business, but rather one that would eventually help them and at the same time would not be the means of causing a milk famine.

The following is a complete list of the amendments suggested to the proposed Milk Ordinance for Maui at the above mentioned meeting:

First. Amend the title by striking out the word "disposition" and inserting the words "disposing for gain or profit."

New Section 1. The term "milk producer or milk vender" used herein shall mean any person, persons, firm or corporation actively engaged in the sale of, or otherwise disposing of, for gain or profit, milk and the products thereof produced or manufactured within the districts of Lahaina, Wailuku and Makawao in the County of Maui. The term "milk" shall mean the milk of the cow, the female of domestic cattle and for the purposes of this ordinance shall include all and any products of such milk produced or manufactured within the County of Maui. The term "cow" shall mean the female of domestic cattle used for the purpose of producing milk for sale, for human consumption and for the purposes of this ordinance shall include all other bovine animals herded or pastured therewith.

Section 5 which will now be Section 6. Add the word "number" after the word "permit" in line 8.

Section 6 which will now be Section 7. Insert the words "any milk in quantities less than one (1) gallon or fluid" before the word "products" in the fifth line.

Section 8 which will now be Section 9. Change three per-centum (3%) to read two and three quarters per centum (2¾%) in *condition 2.*

Condition 5. After the word "removed" add "except as otherwise specified in 'skimmed milk' and milk which immediately upon being drawn from the cow has not been removed from the stable yard or milking-place to a milk room so constructed as to exclude dust and flies, there strained through a double layer of clean cheese-cloth, etc."

Section 10 which will now be Section 11. Change this to read "The Deputy Territorial Veterinarian and the County Physicians of the various districts of the County of Maui, etc."

In line 9, Section 10 which will now be Section 11. After the word "shall" insert the words "subject to the Deputy Territorial Veterinarian and the County Physicians of the various districts of the County of Maui."

Include in all the subsequent Sections: "The Deputy Territorial Veterinarian" with the County Physicians excepting that the milk inspector will report only to the County Physician of the district for which he is appointed.

Section 12 *which is now Section* 13. Delete the words "and other duly authorized officers of the County of Maui and any member of the health and sanitation committee of the Board of Supervisors."

Section 15 which is now Section 16. Add the words "such samples so retained shall be analyzed and a copy of the results of such analysis forwarded to the person, persons, or concern from whom the sample was taken, within ninety-six (96) hours of the time of taking the sample and no subsequent samples shall be taken from the said person, persons or concern until the results of the analysis of the former sample have been made known in writing to the said person, persons or concern."

Section 19 which is now Section 20. Add "provided that the penal clauses of this Ordinance shall not take effect until thirty (30) days after the date upon which the Deputy Territorial Veterinarian of Maui reports to the Board of Supervisors that all dairy and herds and hereinbefore described cows in the County of Maui have been tested for tuberculosis or after the owners of untested dairy herds have had ample opportunity of availing themselves of the provision made by the Board of Supervisors for the carrying out of such test.

This Committee suggests that a sufficient sum, say $5,000.00 for the first year be appropriated for carrying out the provisions of this Ordinance and also that Dr. J. C. Fitzgerald, the present Deputy Territorial Veterinarian on Maui, be appointed County Veterinarian in and for the County of Maui under such salary and with such specific duties as your Honorable Board may deem advisable.

The necessity for the Government having complete and effective control of the milk supply cannot be disputed when consideration is taken of the daily risks being run in drinking milk from dairies that are conducted on unsanitary and ignorant principles. Infant mortality from tuberculosis is increasing in the Islands and its cause, in most cases, is attributed to milk. The sources of infection of Infantile Paralysis is also through the milk supply. With these diseases jeopardizing the lives of children, who are the principal milk consumers, it should behoove the inhabitants of these Islands to do all in their power to have their milk supply under such control that these risks will be minimized, and at the same time, they should make every effort in their power for the eradication of Bovine Tuberculosis.

There is every reason to believe that with the necessary efforts and proper methods, this can and will be accomplished when consideration is taken of the amount of good work that has been done on Oahu in this direction in so short a space of time.

QUARANTINE STATION.

The need of a Government Quarantine Station on Maui has been felt for a long time and importers of live stock frequently suffered considerable inconvenience and expense as a result of having to supply their own quarantine quarters when importing stock to this Island. These inconveniences will soon be done away with, as all preparations have been made for the erection of a Territorial Quarantine Station near Kahului. Through the courtesy of Mr. F. F. Baldwin a piece of land has been leased to the Territory for this purpose. This land is situated facing on the main road, on well drained sandy soil with good shade trees and adjacent to a good water supply.

This site was surveyed by Mr. A. W. Collins of the H. C. & S. Co., who has submitted plans to the Honolulu office. In the near future the necessary corrals, isolation quarters and loose boxes for stallions will be erected.

The Quarantine Station, besides being a great convenience to importers of live stock, is a necessity in cases of contagious diseases occurring among the stock of people who are not responsible and cannot realize what infection and contagion mean. With such people it is next to impossible to establish an efficient quarantine on their own premises and the only method by which the public safety can be insured is by a Quarantine Station.

Report of the Deputy Territorial Veterinarian for the Kauai District.

By

A. R. Glaisyer, D. V. M.

INTRODUCTION.

I have the honor to submit my report as Deputy Territorial Veterinarian for Kauai for the biennial period ending December 31, 1912.

I am glad again to be able to state that this Island is absolutely free from glanders. This satisfactory condition of affairs has obtained for some years, and it is the policy of this office to keep it so by a personal examination every month of all stock on the various plantations or owned by the Government. It is harder to keep track of the various animals owned by Orientals and other small proprietors, but owing to everybody being interested, a close watch is kept and any cases of a suspicious nature are frequently reported to us for investigation.

I believe this condition to be solely the result of the rigid quarantine in Honolulu and wish to state, that in my opinion nothing should ever be done to shorten the time of quarantine,, and any attempts to annul it on the grounds of the mallein test on the Coast should at once be frowned upon·

In this respect also I wish to say that although I have never in my four years here encountered a case of rabies, or any suspicious case even, I most unqualifiedly approve of the dog quarantine. In a country of these climatic conditions, and a country of mongrel dogs, one rabid dog at large would cause incalculable danger to the community.

In 1911 this Island was infected with a virulent outbreak of distemper or strangles among the horses which was much more virulent than is usually encountered here. We regularly have a small outbreak but this one was remarkable for its severity and virulence, and came later in the season than is customary. I am unable to discover any reason for this increased virulence as climatic conditions did not warrant it. Some plantations were severely handicapped by having nearly all their saddle horses laid up; on one plantation there being at one time 60 head in the hospital. Mules did not seem to be much affected. In treating large numbers of these cases I found the best and simplest way was to purchase quantities of mustard for plasters, make up large quantities of Potassium Nitrate solution and leave this to be given by the stable foreman. Raw linseed oil, if the case was not

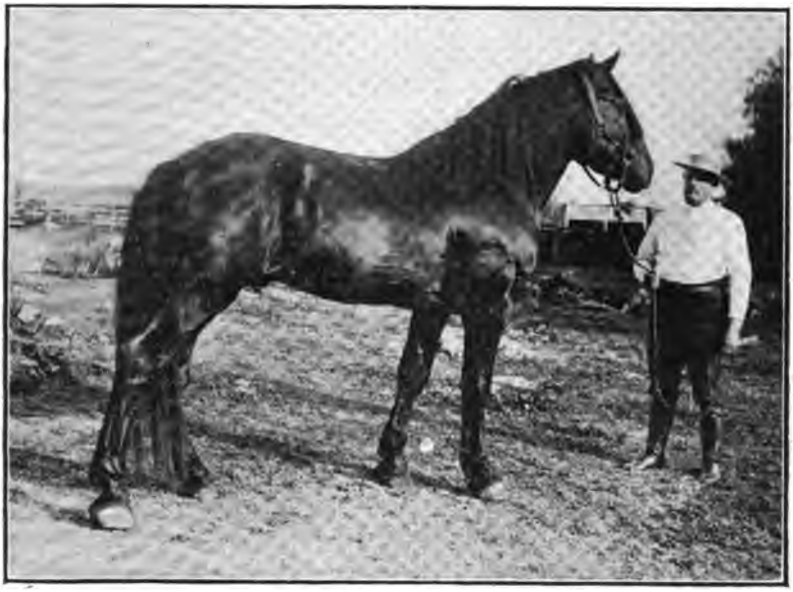


Plate 35. Fig. 1. **Solum.** Head of the stud owned by W. H. Rice, Sr.

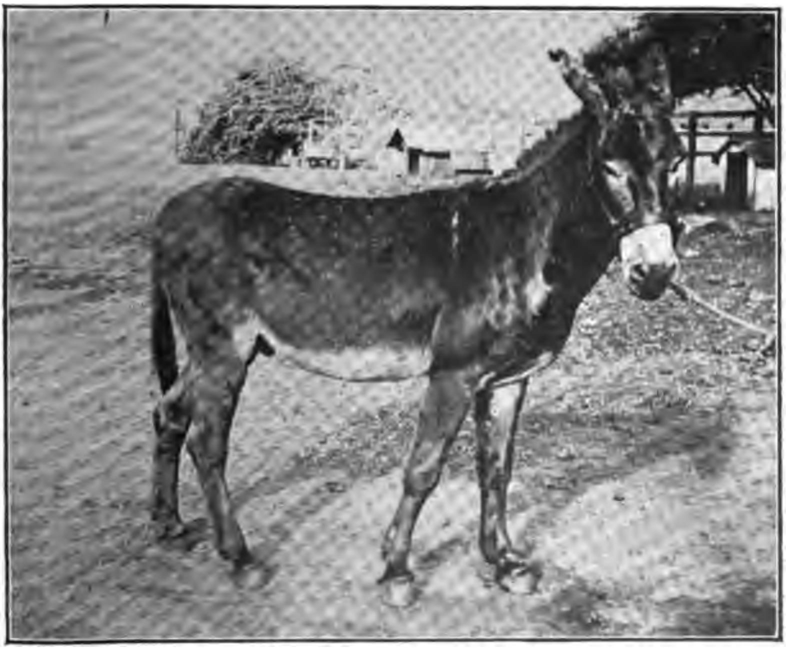


Plate 35. Fig. 2. **Imported Jack.** Owned by Lihue Plantation Co.

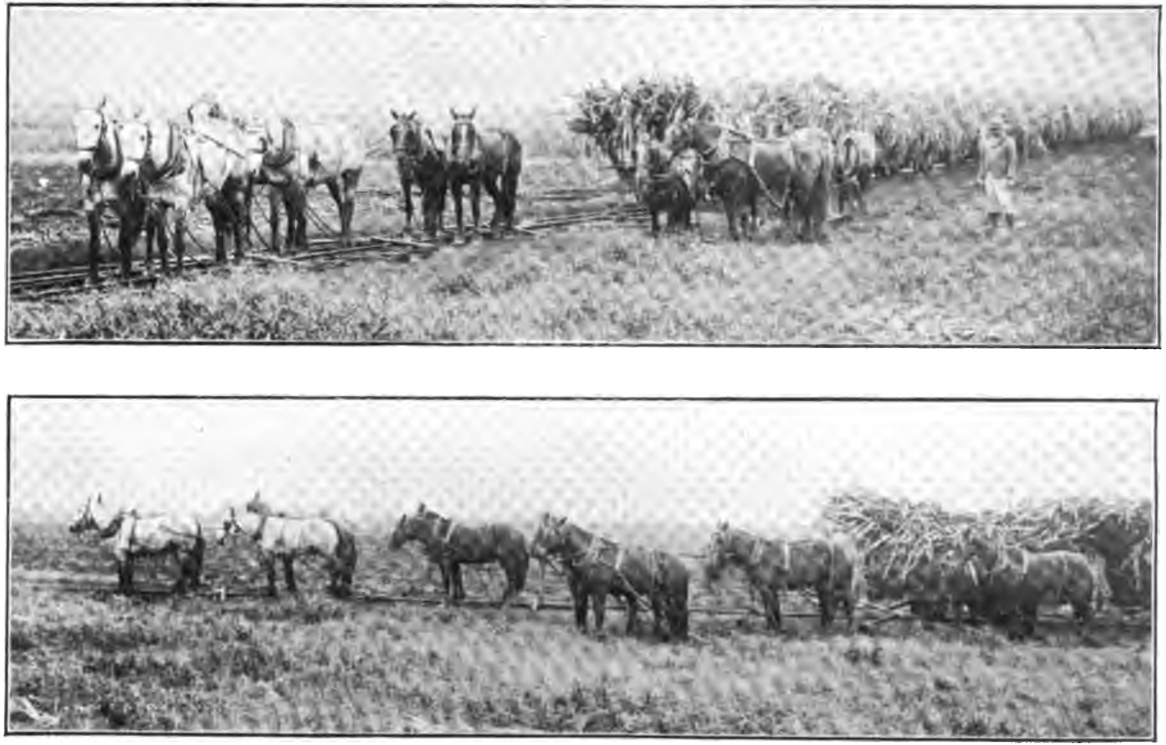


Plate 36. **Draft Horses.** Raised by W. H. Rice, Sr., of Kauai.

too bad, might also be left, while personally I would give injections of antistrangles serum. (Pasteur).

In the majority of cases this worked perfectly, and after the abcesses were opened, a tonic for a few days and the animal could work. As my territory covers a distance of 65 miles, it will be seen that all cases could not be carefully watched, and much had necessarily to be left to the stable foreman. During this outbreak I treated over 250 cases and was fortunate in only losing two. The value of stock saved, at a low estimate, more than paid for the services of a veterinarian for several years, only counting the graver cases.

In 1912, there was no epidemic, but only sporadic cases here and there. This I believe in great measure was due to the education of the stablemen the year before, who were more or less able to recognize the premonitory symptoms and, in some cases at least, to isolate the suspicious ones, pending my arrival.

In 1911, a case of contagious ulcerative lymphangitis was discovered in one plantation stable, in a mare recently imported from the Coast. Fortunately she had not come in contact with many head of stock and had infected but one mule. These animals were isolated long enough to make a positive diagnosis, and were then destroyed. Complete and thorough disinfection was at once applied where they had been, and a promising epidemic of severe character prevented.

DISEASES OF LIVE STOCK.

CEREBRO SPINAL MENINGITIS.

I am also happy to record the fact that for over two years we have not had an outbreak of cerebro-spinal meningitis, the last outbreak having occurred in 1910. In view of the appalling losses from this disease on the mainland this is indeed a matter for congratulation.

TETANUS.

To my knowledge there have been only two cases of tetanus in humans in the last two years. In my practice I have encountered three cases. In all three the cause was the same, viz:—a nail prick. Two of these cases died, and one recovered. The treatment in all cases was the same; pain stilling remedies, when possible by the mouth, and when not, per rectum; confinement in a darkened stall, perfect quiet, and the use of antitetanic serum.

I do not think very highly of antitetanic serum as a curative agent, except perhaps in very large and constantly increasing doses, starting with 1,500 units and doubling the next time, up to 30,000 or 40,000 units.

I use antitetanic serum as a prophylactic, however, whenever I can, and believe that in ordinary severe nail pricks the injection of 1,500 units of the serum is an almost sure preventive, and should be used whenever infection is suspected.

INTESTINAL PARASITES.

There has not been a very large loss from intestinal worms on Kauai for the past two years owing, I believe, to the prophylactic measures we have employed.

Nearly all watering troughs are now being supplied through a sand and rock filter. This of course does not prevent animals from becoming infected with the parasites when drinking at noon in the field, but certainly lessens the chances 66 per cent. In addition where worm colic has been prevalent, we once or twice a year drench all stock with 3 oz. of turpentine in about one pint of warm milk, following with a quart of raw linseed oil.

Every year about May or June we have been obliged to treat a condition erroneously termed locally "staggers." It is invariably in colts pastured in low lying districts, and the history and symptomology never vary. There is no temperature, and the pulse is good. The excretions are normal. Mucous membranes slightly pale. Spasms when excited, much resembling those of tetanus, causing the patients to contract the neck, and shortening the step while walking, sometimes throwing them down.

These colts almost invariably recover spontaneously if removed to a mountain pasture for a couple of months, but if returned under that time they are usually subject to another attack. If kept in a paddock for a day or two and treated with chloral hydrate they rapidly recover. I have examined these pastures with a botanist but have been unable to determine what weed might be causing this trouble, but judging from reports of similar outbreaks in other countries, it is more likely that the tetanic symptoms are caused by the toxins produced by intestinal worms in large numbers.

HEART WORM.

The Filaria Immitis is very prevalent on Kauai, so much so that a dog four or five years old is a rarity. I have made some experiments with various vermifuges but with little or no success. Only one case, and I do not know whether that is due to the efficacy of the drug or not, I would call to your attention. The subject is a fox terrier, property of the writer. He was whelped July 26, 1909, and in January, 1910, showed unmistakable symptoms of heart-worm. He has since then received five grains of thymol every week, and while still undoubtedly affected with the disease is still living and strong. This is the only case under my observation that has lived that long, and I therefore submit the fact for what it is worth.

TUBERCULOSIS.

No systematic campaign of tuberculosis eradication has been conducted here. Tests have been undertaken when desired by owners and the reacting cattle without exception have been destroyed. In some places tuberculosis has been completely eradicated by testing every six months as, for instance, the Kilauea Plantation Dairy herd, and that of Mr. B. D. Baldwin of Makaweli. However, I am glad to state that public interest has been awakened, and I have met with a measure of support in my efforts to bring this matter before the public.

An ordinance to regulate the sale of milk was introduced at the last meeting, January 6, 1913, of the Board of Supervisors, and a committee was appointed to work it out. This movement has the cordial support of all the thinking public, and this ordinance will undoubtedly be passed. As much as I would like to see it, I do not think conditions here will admit of the testing of the milk itself, bacterial count, etc. When the large district is considered, it will be acknowledged a great step to cut out all tubercular cows, and all with any sort of disease. Also to insist upon proper sanitation of dairies, and a sanitary distribution of milk. With the co-operation of the public, and more essential yet, the proper financal assistance I see no reason why in two or three years this county cannot be completely freed of bovine tuberculosis. Taking into consideration the conclusions now definitely agreed upon by scientists of all nations, viz:—Report of the International Tuberculosis Congress at Rome, in which it is definitely proved that 25% of tubercular children up to the age of 16 years are afflicted with the bovine type of the disease, and remembering that each child thus infected is again a focus of infection, it certainly behooves us to let no step remain untried which may lead to its complete eradication. To that end I most earnestly hope that liberal financial assistance may not be lacking for the coming years, so that we may demonstrate in the Island of Kauai the feasibility and practicability of complete local extermination of this dreadful disease.

I am using almost exclusively the intradermal test and consider it far superior to the subcutaneous test. The facility and ease with which it can be applied, its proven reliability and the fact that it requires only two visits to each animal as compared to six or seven with the subcutaneous test, speaks highly for its value.

PRACTICE IN GENERAL.

The practice of a veterinarian on this island is of course chiefly with the different plantations. The work is mostly of a surgical nature, lameness, operative cases, minor illnesses, and the usual cases of digestive troubles. As I mentioned in a previous report, I find the great percentage of alimentary troubles are intersusception and volvulus of the bowels, due in my opinion to the ingestion of chopped cane tops. Also a very obstinate form of impaction due sometimes to horses gorging themselves on algaroba beans when running in pasture.

A veterinarian can save his clients hundreds of dollars a year by the attention paid to such things as collar sores and shoeing, as the animals laid up by the neglect of little things soon makes a number of mules incapacitated, and causes a serious diminution of the number of working head. It is not only by the number of animals treated for disease that the veterinarian best proves his work but by the number of stock he keeps at their duties.

LIVE STOCK BREEDING.

During the past two years great strides have been made in the character of breeding stock, among which may be mentioned:—

The purchase of a Mammoth Jack by Kekaka Plantation. This plantation has always taken a great interest in stock breeding, especially saddle horses, and light mules. It has demonstrated beyond a doubt the feasibility of raising mules for saddle and packing purposes, and there seems to be no reason why, if larger mares were available, work mules could not be raised. The small mules raised at Kekaha are superior to the ordinary horse for saddle purposes, they keep up on less grain, and last longer. I submit photos of a bunch of mule colts, the jack, and a twenty-four year old mare with a yearling mule colt at her side.

The McBryde Plantation now raise all their own saddle horses, the stud being headed by "Romeo," a "Sunnyboy" colt, originally bought from the Koloa Plantation. The type of horses raised here are well adapted to all kinds of plantation work, though not large, running to about 800 pounds.

Koloa Plantation in 1911 purchased a thoroughbred colt whose get is most promising. In addition to this they still have their old stallion "Rebel Chief" and a Shire. This Shire has been in stud for some years, and Koloa Plantation buys no more mules, and has not for five years, doing nearly all their work, with horses raised at home. The geldings and mares average from 1150 to 1300 lbs., which is sufficient proof that horses of good size can be raised in these Islands.

To prove what can be done by selection and good sires, however, one must notice the horses raised by Mr. W. Hyde-Rice on his ranch. There are at least three six-line teams of mares averaging 1450 to 1500 pounds apiece, in addition to all the other horses he uses on the plantation and for other work.

This has been the work of years, by careful breeding of imported mares, and selection from their progeny. The horses at present working here are the get of Solum, a Shire, whose photo is submitted, and some of the teams. To breed horses of this size entailed quite a large expense at first, as it was necessary to import the mares, and these mares often would not raise more than one colt satisfactorily, being unaccustomed to pasture, and unacclimatized here.

In conjunction with Lihue Plantation, Mr. W. Hyde-Rice has recently purchased a Belgian Stallion to be used in his stud. This is a big horse weighing about 1900 pounds and great things are expected of his colts.

In addition Mr. Rice acquired last year the celebrated stallion "Workman," well known 5 and 6 years ago on the Eastern tracks and Cuba. He has been in stud less than a year so nothing can be said as yet of his success as a breeder.

The Lihue Plantation Company has used the same stallion for a number of years at the Lihue Ranch and with corresponding results. In addition they have recently purchased eight heavy mares from the Coast, which, with those they have raised themselves, put them in a position in a very few years to raise their own draft horses. In addition to this mares are also bred to an imported jack with good results.

The saddle horse end is being attended to by the purchase of a splendid Arabian stallion who is now in service on their ranch.

The Makee Sugar Company continues its breeding of thoroughbreds but have made no recent importations of new stock.

The Kilauea Plantation Company has entered into the breeding of draugh animals by the purchase of a Percheron stallion, eight mares, mostly Percheron, and some Clydes and Shires. In addition to this their native mares have been bred and the grades are large and of beautiful type, and show that in three or four years more Kilauea will also be producing its own draft stock. Besides this the plantation dairy herd is headed by an imported Jersey bull.

Princeville Plantation continues to import Hereford bulls and heifers to head the pure bred herd, and has about thirteen Hereford bulls running on the range. This breed has again demonstrated its superior quality as rustlers, and the potency of the strain is so effective that scarcely nothing can be seen here but "white faces."

In conclusion I wish to say that on the whole the outlook of the breeding industry is most promising, as owners are now using more care in selection of their breeding animals.

The health of live stock has been distinctly good for the year 1912, and very fair for 1911, and if funds can be secured this year to carry on the work of tuberculosis control, I see no reason why this scourge should not be entirely eradicated from this island in two or three years.

BOARD OF AGRICULTURE AND FORESTRY

PUBLICATIONS FOR DISTRIBUTION.

Any one or all of the publications listed below (except those marked *) will be sent to residents of this Territory, free, upon application to Mailing Clerk, P. O. Box 207, Honolulu, Hawaii.

BOARD.

*Report of the Commissioner of Agriculture and Forestry for 1900; 66 pp.

*Report of the Commissioner of Agriculture and Forestry for 1902; 88 pp.

*First Report of the Board of Commissioners of Agriculture and Forestry, from July 1, 1903 to December 31, 1904; 170 pp.

Second Report of the Board of Commissioners of Agriculture and Forestry, for the year ending December 31, 1905; 240 pp.; 8 plates; 10 text figures.

Third Report of the Board of Commissioners of Agriculture and Forestry, for the year ending December 31, 1906; 212 pp.; 8 plates; 4 maps; 7 text figures.

Fourth Report of the Board of Commissioners of Agriculture and Forestry, for the calendar year ending December 31, 1907; 202 pp.; 7 plates.

Fifth Report of the Board of Commissioners of Agriculture and Forestry, for the calendar year ending December 31, 1908; 218 pp.; 34 plates.

Report of the Board of Commissioners of Agriculture and Forestry, for the biennial period ending December 31, 1910; 240 pp.; 45 plates.

Report of the Board of Commissioners of Agriculture and Forestry, for the biennial period ending December 31, 1912. (This report.)

"Notice to Importers." by H. E. Cooper; 4 pp.; 1903.

"Digest of the Statutes Relating to Importation of Soils, Plants, Fruits, Vegetables, etc., into the Territory of Hawaii." General Circular No. 1; 6 pp.

"Important Notice to Ship Owners, Fruit Importers and Other Rules and Regulations Prohibiting the Introduction of Certain Pests and Animals into the Territory of Hawaii." General Circular No. 2; 3 pp.; 1904.

"Laws and Regulations, Importation and Inspection of Honey Bees and Honey." General Circular No. 3; 7 pp.; 1908.

Act 71, Session Laws of 1905; "To Provide for the Protection of Forest Land Within the Territory from Fire." On Brush-burning Permit Form; 1905.

Act 104, Session Laws of 1907; "To Provide for the Protection of Birds Beneficial to the Forests of the Territory of Hawaii." Unnumbered leaflet; 1907.

Pure Seed Law. Act 107, Session Laws of 1911; "To Regulate the Importation and Sale of Seed Into and Within the Territory of Hawaii." Unnumbered leaflet; 4 pp.; 1911.

"The Hawaiian Forester and Agriculturist," a monthly magazine. Vols. I to IX; 1904-1912. To be obtained from the Hawaiian Gazette Co., Honolulu, Hawaii. Price $1 a year. (Issued under the auspices of the Board.)

DIVISION OF FORESTRY.

"Eucalyptus Culture in Hawaii," by Louis Margolin. Bulletin No. 1; 88 pp.; 12 plates; July, 1911.

"An Offer of Practical Assistance to Tree Planters." Circular No. 1; 6 pp.; 1905.

"Instructions for Propagating Forest, Shade and Ornamental Trees," by David Haughs; Circular No. 2; 11 pp.; June, 1912.

* "Forest and Ornamental Tree Seed for Sale at Government Nursery." Press Bulletin No. 1; 3 pp.; 1905.

* "Suggestions in Regard to the Arbor Day Tree Planting Contest." Press Bulletin No. 2; 7 pp.; 1905.

"Revised List of Forest and Ornamental Tree Seed for Sale at the Government Nursery." Press Bulletin No. 3; 4 pp.; 1906.

* "Instructions for Propagating and Planting Forest Trees." Press Bulletin No. 4; 4 pp.; 1906.

* "Instructions for Planting Forest, Shade and Ornamental Trees." Press Bulletin No. 5; 7 pp.; 1909.

"Na Hoakaka no ke Kanu Ana i na Laau Malumalu ame na Laau Hoohiwahiwa." Press Bulletin No. 6; 8 pp.; 1909.

Report of the Division of Forestry, for the year ending December 21, 1905. Reprint from Second Report of the Board; 77 pp.; 5 plates.

* Report of the Division of Forestry, for the year ending December 31, 1906. Reprint from Third Report of the Board; 123 pp.; 4 maps.

Report of the Division of Forestry, for the year ending December 31, 1907. Reprint from Fourth Report of the Board; 70 pp.

Report of the Division of Forestry, for the year ending December 31, 1908. Reprint from Fifth Report of the Board; 85 pp.

Report of the Division of Forestry, for the biennial period ending December 31, 1910. Reprint from Report of the Board; 86 pp.; 32 plates.

Report of the Division of Forestry, for the biennial period ending December 31, 1912. Reprint from Report of the Board. (This report.)

Botany.

"New and Noteworthy Hawaiian Plants," by Dr. L. Radlkoffer and J. F. Rock. Botanical Bulletin No. 1; 15 pp.; 6 plates; September, 1911.

---

* Out of print.

PUBLICATIONS FOR DISTRIBUTION—(Continued).

DIVISION ON ENTOMOLOGY.

"The Leaf-Hopper of the Sugar Cane," by R. C. L. Perkins. Bulletin No. 1; 38 pp.; 1903.

** "A Catalogue of the Hemipterous Family Aleyrodidae," by G. W. Kirkaldy, and "Aleyrodidae of Hawaii and Fiji with Descriptions of New Species," by Jacob Kotinsky. Bulletin No. 2; 102 pp.; 1 plate; 1907.

* "On Some Diseases of Cane specially Considered in Relation to the Leaf-Hopper Pest and to the Stripping of Cane," by R. C. L. Perkins. Press Bulletin No. 1; 4 pp.; 1904.

"A Circular of Information," by Jacob Kotinsky. Circular No. 1; 8 pp.; 1905.

* "The Japanese Beetle Fungus," by Jacob Kotinsky and Geo. M. Newell. Circular No. 2; 4 pp., cut; 1905.

"Mediterranean Fruit Fly (Ceratitis capitata)," by E. M. Ehrhorn. Circular No. 3; 7 pp.; 2 plates; 1912.

Rule VII: "Concerning the Prevention of Distribution of the Mediterranean Fruit Fly"; unnumbered leaflet; 1910.

Rule VIII: "Concerning the Importation of all Banana Fruit, Banana Shoots or Plants"; unnumbered leaflet; 1911.

Rule IX: "Concerning the Prevention of Distribution of Insect Pests from Oahu to the Other Islands"; unnumbered leaflet; 1911.

Rule X: "Concerning Horticultural Sanitation in and about the City of Honolulu"; unnumbered leaflet; promulgated Nov., 1911; amended Mar., 1912.

Rule XII: "Concerning the Control of Insect and Other Vegetable Pests in the Territory of Hawaii"; unnumbered leaflet; 1912.

Rule XIV: "Concerning Horticultural Sanitation of the Island of Hawaii"; unnumbered leaflet, March, 1912.

Rule XVII: "Concerning the Control of the Mediterranean Fruit Fly and Other Insect and Vegetable Pests"; repealing Rules X, XI, XIV, XV and XVI, unnumbered leaflet September, 1912.

Report of the Division of Entomology, for the year ending December 31, 1905. Reprint from Second Report of the Board; 68 pp.; 3 plates; 11 text figures.

Report of the Division of Entomology, for the year ending December 31, 1906. Reprint from Third Report of the Board; 25 pp., 7 text figures.

Report of the Division of Entomology, for the year ending December 31, 1907. Reprint from Fourth Report of the Board; 13 pp., 1 plate.

Report of the Division of Entomology, for the year ending December 31, 1908. Reprint from Fifth Report of the Board; 26 pp.; 2 plates.

Report of the Division of Entomology, for the biennial period ending December 31, 1910. Reprint from Report of the Board; 70 pp.; 10 plates.

Report of the Division of Entomology, for the biennial period ending December 31, 1912. Reprint from Report of the Board. (This report.)

DIVISION OF ANIMAL INDUSTRY

* "Inspection of Imported Live Stock." Rule 1; 1 p.; 1905.

* "Inspection and Testing of Imported Live Stock for Glanders and Tuberculosis." Rule 2; 1 p.; 1905.

* "Concerning Glandered Horse Stock in the Territory." Rule 3; 1 p.; 1905.

* "To Amend Rule 1, Inspection of Imported Live Stock." Rule 4; 1 p.; 1907.

* "Quarantine of Horse Stock from California." Rule 5; 3 p.; 1908.

"Rules and Regulations. Inspection and Testing of Live Stock Intended for Importation," Rules I to V and Laws; 11 pp.; unnumbered pamphlet; Effective January 1, 1910; Replaces earlier rules.

Rule VI: "Concerning the Quarantine of Dogs for Rabies;" 2 pp.; unnumbered leaflet; 1912.

Report of the Division of Animal Industry, for the year ending December 31, 1905. Reprint from Second Report of the Board; 42 pp.

Report of the Division of Animal Industry, for the year ending December 31, 1906. Reprint from Third Report of the Board; 41 pp.; 3 plates.

Report of the Division of Animal Industry, for the year ending December 31, 1907. Reprint from the Fourth Report of the Board; 104 pp.; 6 plates.

Report of the Division of Animal Industry for the year ending December 31, 1908. Reprint from Fifth Report of the Board; 14 pp.

Report of the Division of Animal Industry, for the biennial period ending December 31, 1910. Reprint from Report of the Board; 59 pp.; 12 plates.

Report of the Division of Animal Industry, for the biennial period ending December 31, 1912. Reprint from Report of the Board. (This report.)

** This Bulletin will be sent only to persons interested in the subject.

* Out of print.

Discard

REPORT

OF THE

Board of Commissioners of Agriculture and Forestry

OF THE

Territory of Hawaii

FOR THE

BIENNIAL PERIOD ENDING DECEMBER 31st, 1914

HONOLULU, T.H.
THE NEW FREEDOM PRESS.
1915.

OFFICERS AND STAFF
OF THE
Board of Commissioners of Agriculture and Forestry
1913–1914

COMMISSIONERS.

WALTER M. GIFFARD, President and Executive Officer.
J. M. DOWSETT
ARTHUR H. RICE
H. M. VON HOLT
ALBERT WATERHOUSE.

DIVISION OF FORESTRY.

RALPH S. HOSMER, Superintendent of Forestry and Chief Fire Warden.
DAVID HAUGHS, Forest Nurseryman.
BRO. MATTHIAS NEWELL, in charge of Sub-Nursery at Hilo, Hawaii.
WALTER D. McBRYDE, in charge of Sub-Nursery at Homestead, Kauai.
JOSEPH F. ROCK, Consulting Botanist.

DIVISION OF HYDROGRAPHY.

G. K. LARRISON, Superintendent of Hydrography.
J. C. DORT, Engineer in Charge, Lihue, Kauai.
C. T. BAILEY, Engineer in Charge, Wailuku, Maui.
H. KIMBLE, Engineer in Charge of Construction, Oahu.
H. A. R. AUSTIN, Junior Engineer, Oahu.
E. E. GOO, Clerk.

DIVISION OF ENTOMOLOGY.

EDWARD M. EHRHORN, Superintendent of Entomology and Chief Plant Inspector.
D. B. KUHNS, Assistant Plant Inspector.
BRO. M. NEWELL, Fruit and Plant Inspector, Hilo, Hawaii.

E. E. MADDEN,	Honorary Plant Inspector at	Mahukona, Hawaii.
E. R. BEVINS,		Kahului, Maui.
W. D. McBRYDE,		Koloa, Kauai.
DR. W. B. DEAS,		Hana, Maui.
CAPT. C. F. TURNE		Kaanapali, Maui.
G. C. MUNRO,		Manele, Lanai.

F. SILVESTRI, Scientific Explorer.
D. T. FULLAWAY, Field Entomologist.
J. C. BRIDWELL, Assistant Field Entomologist.

DIVISION OF ANIMAL INDUSTRY.

VICTOR A. NORGAARD, Superintendent of Animal Industry and Territorial Veterinarian.
L. N. CASE, Assistant Territorial Veterinarian.
H. B. ELLIOT, Deputy Territorial Veterinarian for Hawaii.
J. C. FITZGERALD, Deputy Territorial Veterinarian for Mauai.
A. R. GLAISYER, Deputy Territorial Veterinarian for Kauai.

CLERICAL STAFF.

MRS. A. ORAM, Stenographer and Librarian.
MRS. C. L. SEYBOLT, Clerk.

HAWAIIAN FORESTER AND AGRICULTURIST.

DANIEL LOGAN, Editor.

Hawaii - Board of Commrs. of Agri. and Forestry.

AMERICAN SOCIE
SEP 1[illegible] 1915
OF CIVIL ENGINEE
NEW YORK

REPORT

OF THE

Board of Commissioners of Agriculture and Forestry

OF THE

Territory of Hawaii

FOR THE

BIENNIAL PERIOD ENDING DECEMBER 31st, 1914

HONOLULU. T.H.
THE NEW FREEDOM PRESS.
1915.

YL

1:

Exch
N.Y. Pub. Library.
8-20-28.

CONTENTS

REPORT OF THE COMMISSIONERS.

Page

Introduction 1
Personnel 1
Meetings 1

Publications.

Division of Forestry 2
Division of Entomology 2
Division of Animal Industry 2
Monthly Publication 2

Division of Forestry.

Forest Reserves 3
Protection of Native Forests 3
Forest Planting 4
Experimental Forest Planting 4
Plant Distribution 5
Forest Fires 5
Miscellaneous 6
Staff 6
Recommendations 7

Division of Hydrography.

Scope of Work 8
Utilization Investigations 8
Cooperative Work 8
Other Investigations 9
Staff 9
Recommendations 10

Division of Entomology.

Inspection of Imports 10
Equipment 11
Inter-Island Inspection 12
Fruit Fly Control 12
Federal Horticultural Board 14
Staff 14
Recommendations 15

Division of Animal Industry.

Live Stock Conditions in General 16
Importation of Live Stock 16
Diseases of Live Stock 17
Bovine Tuberculosis Control 17
Staff 18
Recommendations 19
Conclusion 19

Allotments and Expenditures.

Allotments 21
Statement of Expenditures 22
Special Fund 25
Special Appropriation 29

DIVISION OF FORESTRY.

Report of the Superintendent of Forestry.

Introduction 33
Scope of this Report 33
Resume of the Work Performed 33

L.X.
48782

Page
Staff 34
Forest Reserves 34
New Reserves 35
Tables with Forest Reserve Statistics:
Forest Reserves Arranged in Chronological Order.... 38
Forest Reserves Arranged by Islands and Counties.. 41
Fencing Forest Reserve Boundaries 43
Fencing Under Lease Requirements 44
Forest Extension 46
Federal Assistance in Tree Planting 49
Plant Distribution 50
Advice on Forest Matters 52
Plant Introduction 52
Tree Planting Under Private Auspices 53
Miscellaneous Activities 54
Algaroba Licenses 54
Hawaii Hardwood Lumber Company 54
Fence Post Test 55
Permits in Forest Reserves 55
Honorary Forest Rangers 56
Surrender of Forest Land 56
Publications 56
Forest Fires 57
Summary of Forest Work in Hawaii, 1904-1914.... 58
Recommendations 62
List of District Fire Wardens 63
List of Forest Rangers 67
List of District Foresters 67
Report of the Acting Superintendent of Forestry.
Forest Extension 69
Forest Reserve Fencing 70
Dead Timber in Tantalus Forest 70
Arbor Day 70
Table, Number of Trees Planted 1913 and 1914 71
Forestry Rule I 71
Report of the Forest Nurseryman.
Nursery 73
Collection and Exchange of Seed 73
Table, Plant Distribution 74
Propagation of Trees for Plantation Companies, and other Corporations 75
Government Realizations 76
Collections on Account of Preservation and Extension of Forestry and Forest Reserves 76
Other Work 76
Nursery and Grounds 76
Congressional Vegetable Seed and Year Books 77
Advice and Assistance 77
Makiki Station 77
Tantalus Forest 78
Honolulu Watershed Planting 79
Report of the Consulting Botanist 81

DIVISION OF HYDROGRAPHY.

Report of the Superintendent of Hydrography.
Introduction 85
Act 56 85

Page
Act 57 85
Scope of Work 87
Work Accomplished 88
Utilization Investigations 53
Cooperative Work 89
Honolulu Water Supply 89
Kona, Hawaii, Investigation 90
Special Investigation Work 90
Windward Kauai Water 90
Rainfall Measurement Stations 91
Publicity and Availability of Information 91
Recommendations 92
Financial Statement 93

List of Stream Gaging Stations.

Island of Kauai 94
Island of Oahu 94
Island of Maui 95
Island of Hawaii 96

List of Ditch Gaging Stations.

Island of Kauai 96
Island of Oahu 97
Island of Maui 97
Island of Hawaii 98

List of Rainfall Gaging Stations.

Island of Kauai 98
Island of Oahu 99
Island of Maui 99
Island of Hawaii 99
Kona, Island of Hawaii 100
List of Cooperative Stream and Ditch Measurement Stations 101
Summary 102

DIVISION OF ENTOMOLOGY.

Report of the Superintendent of Entomology.

Introduction 103
Staff 104
Work Performed 105
Rice and Bean Shipments 105
Equipment 106
Inter-Island Inspection 107
Tables: Monthly Inspection, Honolulu, 1913 109
Monthly Inspection, Honolulu, 1914 110
Monthly Inspection, Hilo, 1913 111
Monthly Inspection, Hilo, 1914 111
Fruits and Vegetables, Honolulu, 1913 112
Fruits and Vegetables, Honolulu, 1914 114
Fruits and Vegetables, Honolulu, 1913, Foreign.. 116
Fruits and Vegetables, Honolulu, 1914, Foreign.. 118
Fruits and Vegetables, Hilo, 1913 120
Fruits and Vegetables, Hilo, 1914 122
Inter-Island Report, 1913-1914 124
Pests Intercepted 125
Federal Horticultural Board 131
Insect Pests and Remedies 135
Pineapple Disease 141
Rule XVIII, Concerning Shipping Pineapples from Kauai and Oahu 141

Page
Recommendations 142
Report of the Work of the Insectary 143
Parasitism Among the Larvae of the Mediterranean Fruit Fly.. 153
Table I. Parasitism Among Larvae Developing in Coffeé.... 155
Table II, Percentage of Parasitism Among Larvae Developing in Chinese Oranges 157
Table III, Percentage of Parasitism Among Larvae Developing in Strawberry Guavas 158
Table IV, Percentage of Parasitism Among Larvae Developing in Bestills 159
Table V, Percentage of Parasitism Among Larvae Developing in Winged Kamani 160

DIVISION OF ANIMAL INDUSTRY.

Letter of Submittal.

Statutory Foundation of the Division 163
Live Stock Inspection 164
Glanders 164
Bovine Tuberculosis 165
Sheep Scab 166
Texas Fever 166
Hog Cholera 167
Rabies 168
Suppression of Diseases 169
Glanders 169
Sheep Scab 170
Bovine Tuberculosis 170
Hog Cholera 172
Improvement of Live Stock 173
Summary 176

Report of the Territorial Veterinarian.

The Live Stock Industry of the Territory 177
Rules and Regulations 178
Rule VII, Concerning Hog Cholera 179
Importations of Live Stock 180
Horses 180
Mules 180
Cattle 180
Sheep 181
Hogs 181
Poultry 181
Quarantine Stations 182
Diseases of Live Stock 183
Glanders 183
Bovine Tuberculosis 184
Preventive Measures Against Rabies 185
Hog Cholera 186
Cerebro-Spinal Meningitis in Horse Stock 187
Diseases Among Poultry and Remedies 188
Contagious Epithelioma or Sore Head 188
Apoplectiform Septicemia 190
Intestinal Coccidosis 190
Intestinal Worms 191
The Intradermal Test for Bovine Tuberculosis 192
Technique 193
Dose 193
Character of Reaction 194

Page
        - Results of Test 196
        - Conclusions 196
    - Bacteriological Examination of Milk 196
    - The Control of Bovine Tuberculosis 199
    - Summary 206

Report of the Deputy Territorial Veterinarian for the Hilo District.

- General Observations 208
    - Importations of Live Stock 209
    - Animal Quarantine Station 210
    - The Hawaii County Fair 211
- Contagious and Infectious Diseases 213
    - General Statistics 213
    - Glanders 213
    - Epizootic Cerebro-Spinal Meningitis 213
    - Tetanus 213
    - Endemic Catarrhal Fever 214
    - Bovine Tuberculosis 214
    - Hog Cholera 214
        - Specifications for Pig Pen and Swill House 216
- Dairying Industries in East Hawaii 217
    - Statistics 217
    - Commercial Aspects of the Dairy Industries 221
        - Butter Production 221
        - Milk Production 222
        - Sanitation of Buildings 222
        - Specifications for Dairy and Milk Room 223
    - Quality of Dairy Cattle 224
    - Dairy Lands and Food Stuffs 225
- The Eradication of Bovine Tuberculosis 226
    - Miscellaneous Cattle Diseases 228

Report of the Deputy Territorial Veterinarian for Maui District.

- Diseases of Live Stock 230
    - Glanders 230
    - Epizootic Lymphangitis 230
    - Bovine Tuberculosis 231
    - Cerebro-Spinal Meningitis 232
    - Strongylus Armatus in Horse Stock 233
    - Contagious Pneumonia in Swine 234
    - San Diego Flea on Chickens 234
- Animal Husbandry 235
    - Stables 236
    - Veterinary Hospitals 236
    - Dairies 236
    - Quarantine Station 237
    - Horse Breeding 237
    - Cattle Breeding 239
    - Hog Raising 240

Report of the Deputy Territorial Veterinarian for Kauai District.

- Live Stock Conditions in General 241
    - Hog Cholera 242
    - Sclerostoma Misnomer (Spinal Meningitis) 243

ILLUSTRATIONS

Plate 1. A Completely Forested Hawaiian Watershed.. Frontispiece
Facing Page
" 2. An Ohia Forest on Hawaii 36
" 3. Planted Forest on Tantalus near Honolulu 48
" 4. Fig. 1. Cutting Algaroba in the Purely Commercial Forest on the Dry Lowlands 54
Fig. 2. Makiki Nursery, Honolulu 54
" 5. Fig. 1. Plants for Distribution, Makiki Nursery 76
Fig. 2. Soil Sterilizing Shed, Makiki Nursery 76
" 6. Fig. 1. Soil Sterilizer, Makiki Nursery 78
Fig. 2. Tin Can Cutter at Makiki Station 78
" 7. A Typical Stream During High Water 88
" 8. A Weir Station 88
" 9. Hydrographer Ready to Make Discharge Measurement with Current Meter and Rod 90
" 10. Hydrographer making a High Water Discharge Measurement from Standard Gaging Car and Cable 90
" 11. A Typical Hawaiian Stream During Low Water 96
" 12. Standard Gaging Car Used in Making High Water Measurements from Cable and Standard House for Sheltering Automatic Register.... 98
" 13. A Typical Suspension Bridge from which High Water Measurements are Made 100
" 14. New Plant Inspector's Office on Pier 7, Honolulu 104
" 15. Fig. 1. Plant Fumigating House, Kilauea St., Honolulu 106
Fig. 2. Timbers Destroyed by Termites or White Ants in Honolulu 106
" 16. Fig. 1. Mail Shipment of Twigs from Japan Containing Wood-boring Larvae 126
Fig. 2. Wood-boring Larvae sent from Japan for Medicinal Purposes 126
" 17. Natural Enemies of Citrus Mealy Bugs and Aphids..... 138
" 18. Method of Liberating Larval Parasites of the Fruit Fly
Fig. 1. Adjusting Tent 144
Fig. 2. Tent in Place with Parasites Confined 144
" 19. Insectary Used for Propagation of Introduced Parasites 148
" 20. The Intradermal Tuberculin Test and Typical Reactions 192
" 21. Parts of new Hilo Animal Quarantine Station 210
" 22. Model of Dairy Barn and Milk Room 224
" 23. Six Prize Winning Polled Angus Bulls, Grove Ranch, Maui 236
" 24. Polled Angus Purebred Cows and Heifers, Grove Ranch, Maui 236
" 25. Thoroughbred Stallion "Sileo," by St. Andrew ex Silentia 238
" 26. Three Promising Colts from Maui 240
Fig. 1. "Dutch Parrot" by Deutschland ex Northwest. 240
Fig. 2. "Senator B," by Sileo ex Delagoa 240
Fig. 3. "Copra," by Sileo ex Coppit 240

Plate 1. **A Completely Forested Hawaiian Watershed.** Photo by R. K. Bonine

BOARD OF AGRICULTURE AND FORESTRY

Report of the Commissioners

Honolulu, December 31, 1914.

Hon. Lucius E. Pinkham,
Governor of Hawaii,
Honolulu, Hawaii.

Sir:—The Board of Commissioners of Agriculture and Forestry has the honor to present herewith its report for the biennial period ending December 31, 1914.

PERSONNEL.

There have been no changes in the personnel of the Board during the past biennial period, but two of the Commissioners, whose terms had expired, were reappointed, viz.: Mr. W. M. Giffard was reappointed as President and Commissioner, and Mr. J. M. Dowsett was reappointed as a Commissioner on January 9, 1914. During 1913 and the early part of 1914, Mr. Giffard was in active charge of all work of the Board, but, owing to ill health, he was compelled to be away during the remaining months of the period, and in his absence Mr. Albert Waterhouse acted in his place.

MEETINGS.

During the calendar years 1913 and 1914 the Board held 48 regular and special public meetings, and in addition thereto held five joint meetings with the Governor for public hearings on the establishment of forest reserves. The several standing committees of the Board have also held numerous meetings to consider such matters as had been submitted to them for investigation and recommendation.

PUBLICATIONS.

DIVISION OF FORESTRY.

Rule I—Concerning the protection of the watersheds in Nuuanu and Makiki Valleys (Honolulu Watershed Forest Reserve), August 27, 1914.

Botanical Bulletin No. 2—"List of Hawaiian Names of Plants," by J. F. Rock, June, 1913.

Bulletin in MSS. form.—"The Native Forests of the Hawaiian Islands," by J. F. Rock, for publication later.

DIVISION OF ENTOMOLOGY.

Rule XVIII—Concerning the control of fungus diseases on pineapples, Island of Kauai, May 24, 1913.

Rule XVIII—Amended to include Island of Oahu, June 30, 1914

Bulletin No. 3—"Report of an Expedition to Africa in Search of the Natural Enemies of Fruit Flies," by Prof. F. Silvestri, February, 1914.

DIVISION OF ANIMAL INDUSTRY.

Rule VII.—Concerning the shipment of hogs from the Island of Oahu to any other island in the Territory of Hawaii, July 10, 1913.

MONTHLY PUBLICATION.

Vols. X and XI.—"Hawaiian Forester and Agriculturist."

DIVISION OF FORESTRY.

The main activities of the Division of Forestry during the past biennial period have been, as throughout the last decade, the protection of the native forests on the important watersheds and the planting of trees. The setting aside of forest reserves, the first step necessary in forest protection, has progressed so far that now only a few areas in the Territory remain to be so reserved. This has been followed by an actual beginning in the real administration of the reserves by fencing many miles of forest boundary and by the eradication of some of the wild animals which are destructive to our native forests. A good start has been made in planting on the reserves where it is needed, and the planting of trees by corporations and individuals on waste land in cooperation with this division has continued during the past two years in a satisfactory manner.

FOREST RESERVES.

The paramount value of forest cover for conserving the sources of water on drainage areas and for regulating the runoff on these Islands, where water is so highly prized, is so well known as to need no further comment. The policy, therefore, of managing our native forests, which are so susceptible to injuries of all kinds, as protection forests in all localities where water is the chief asset, has continued, and to this end the forest reserve system has been extended during the past two years by the addition of ten new reserves. Up to the close of 1914, thirty-seven forest reserves had been set apart by proclamation of the Governor of the Territory. The aggregate area of the forest reserves in the Territory is now 798,214 acres, of which 546,222 acres, or 68 per cent is land belonging to the Territory. The size of one reserve was slightly reduced, but the total resulting increase in area in the whole reserve system during the past two years was 115,113 acres, of which 91,412 acres is government land. From at least one view-point the most important of these new reserves is the Honolulu Watershed Forest Reserve, which includes the forested valleys back of Honolulu from Kalihi to Palolo valleys, and on which the conservation of water for the city is of paramount importance. Only a few areas of government forest land remain to be set aside to complete the general forest reserve system, and these will receive early attention. An owner of land at the head of Manoa Valley, Oahu, has substantiated his belief in the practice of forestry by turning over to the government as a forest reserve, for a period of five years, 132 acres of forest land. This confirms the precedent established eight years ago when a large tract of land on the windward side of Maui was entrusted by a corporation to the care of the Board.

PROTECTION OF NATIVE FORESTS.

The passage of Act 57 by the last session of the Legislature, on the recommendation of the Board, whereby one-half of the revenues from territorial water licenses was available for the Division of Forestry and the other half for the newly created Division of Hydrography, was a most justifiable and satisfactory action, and enabled the Division of Forestry to make great advance in the better care of the Hawaiian forests. By the funds which thereby became available it was possible to expand the regular work of the division, and undertake some new and important fencing projects. This was accomplished without increasing the force. Nine fencing projects on boundaries of reserves where the protection of the forests from wandering stock was urgently needed were undertaken and completed and plans were laid for other projects needing attention, but these had to be postponed in the spring of 1914 when retrenchment at the request of the Governor became necessary. On three of the islands the fencing of additional forest lands has also been accomplished under general lease requirements. This has helped greatly toward the desired goal when all damage to the native forests by marauding animals shall cease.

FOREST PLANTING.

Planting of trees on the forest reserves has actually begun and a good start made with the funds that have been available. Realizing the importance to the city of the reserve back of Honolulu, the planting up of open places was begun in July, 1913, and has continued throughout the period. The native koa and kukui have suitably been used for this purpose, and the young trees have been set out carefully on the slopes of Sugar Loaf back of the springs in the branches of Makiki Valley. To date 7,883 trees on about forty acres have been set out, and it is planned to continue the planting until all of the native forest in the region has been restored. Other planting on reserves has been done along the Koolau ditch system on Maui, where the native forest died off six to eight years ago, on the Waihou Spring Reserve, on the West Maui Reserve back of Wailuku, and in the Makawao Reserve near Kailiili on Maui, on the water reserve at Pupukea, Oahu, and at Moloaa, Kauai.

EXPERIMENTAL FOREST PLANTING.

Considerable progress has been made in the experimental planting of exotic species. Stands of Japanese cedar and Norfolk Island pine have been set out by Mr. Walter D. McBryde under the direction of the forester at Homestead, Kauai, and many species of trees new to Hawaii have been started and planted out in Makiki back of the experimental garden. A juniper introduced by Mr. Gerrit P. Wilder about four years ago already shows great promise by its rapid growth, and a variety of trees and plants grown from seed collected by our Consulting Botanist, Mr. Joseph F. Rock in tropical Asia and Africa have come up and are doing well. The experimental plantation of eighteen different species of eucalyptus established during the last few years by financial assistance from the Federal Forest Service is well established and growing nicely, and it is hoped that in the future similar additional assistance will be forthcoming.

The introduction and establishment of exotic trees of real timber value on the higher elevations of the islands where the land is not suitable for grazing and where there is practically no water to conserve, is a matter that needs further and particular attention and liberal provision should be made for the extension of this work.

PLANT DISTRIBUTION.

The propagation and distribution of seedling trees from the Honolulu nursery, free and at a cost to individuals and to corporations, respectively, has continued as in former years. This has been supplemented by the distribution of young trees from the subnurseries at Homestead, Kauai, and at Hilo, Hawaii. The recipients have largely been corporations which desire to raise fuel wood on odd pieces of waste land. The fact that they have planted over one million seedlings during the last two years is evidence that this has become an established industry in the Territory. Other recipients of seedling trees have been homesteaders, into whose hands a special effort has been made to get free trees, and other individuals who have planted the trees mainly on school grounds and along roadsides. In this manner there were sent out from all government nurseries in 1913 a total of 517,399 trees and 217,082 in 1914, making a total of 734,481 trees for the past biennial period. These figures include some ornamental shrubs which have been especially raised for the army to make its several quarters habitable and more attractive. The care which has been given to planted trees and shrubs by the army is most gratifying.

Continued interest was shown in tree planting on Arbor Day. On this occasion in 1913 over 11,000 seedlings and in 1914 over 17,000 seedlings were distributed free.

As in the past, in connection with tree planting this Division has continued to supply information concerning all kinds of forest and nursery work. It has also cooperated with the Land Office by taking charge of improvement thinnings in algaroba forests under government leases on Oahu and Maui and in other forest matters.

FOREST FIRES.

Although the fires during the past period were mostly in grass or brush, and did little damage, there is need of being constantly on the alert and prepared for any emergency. During the period there were twelve fires on four of the islands, but all were checked before they reached the forest. The system of District Fire Wardens has been kept fully organized, and much credit is due the gentlemen who have thus acted gratuitously for the Board. A new departure in 1914 was the appointment, as Volunteer Forest Rangers, of three gentlemen who are in a position to give closer attention to forest matters in behalf of the Board. But in time of real danger from forest fires the Board cannot expect free services for work in this line. A liberal appropriation should therefore be made for fighting fires during the coming biennial period.

MISCELLANEOUS.

During the past biennial period several opinions have been rendered by the Attorney-General of the Territory, upon request by the Board, which have defined the powers of the Board and limitations on its actions. Most of these pertain to the Division of Forestry and have enabled the work of this division to proceed on a more definite and satisfactory basis.

To test the durability and usefulness of eucalyptus as fence posts the division has cut from the Tantalus forest posts from five different species of eucalyptus. By cooperation between the Board of Agriculture and Forestry and the College of Hawaii, the latter has set these posts on the college farm. The results of this test should yield much useful information in regard to eucalyptus fence posts.

STAFF.

The only change in the staff of the Division of Forestry during the past two years was the resignation of Mr. Ralph S. Hosmer, as Superintendent of Forestry, which took effect on September 1, 1914, when he left the services of the Board to become head of the Department of Forestry at Cornell University. For his excellent services in organizing and developing forestry in the Territory by his ten years of faithful work in the islands the Board here takes the opportunity to express its heartiest appreciation. Mr. Hosmer has been succeeded by an island man, Mr. Charles S. Judd, who for the past seven years has worked in the U. S. Forest Service on the mainland. Mr. Judd was also previously connected with the Board of Agriculture and Forestry when he held the position of Territorial Land Commissioner for a term under a previous administration. His fundamental knowledge of general forest requirements as well as those necessary to handle the peculiar indigenous tropical forests in this Territory will undoubtedly be of practical service.

RECOMMENDATIONS.

Now that the establishment of a general system of forest reserves has been practically completed, the main work before the Division of Forestry is the actual protection and administration of these reserves. This means (1) the completion of the fencing of the boundaries of the reserves, where fences are needed to keep stock out of the forests; (2) the removal or extermination of stock from the fenced reserves, and (3) the employment of an adequate force of rangers to keep the fences in repair, to prevent trespass on the reserves, and to patrol for forest fires in the dry seasons. Other activities that will necessarily continue will be the encouragement of tree planting on waste woodland, and in this connection it is proposed to make a special study of the demand for and present supply of fuel wood in the Territory, the planting of trees where they are needed on the indigenous forest reserves, the continuation of investigations concerning timber trees of economic value which will do well on the higher elevations of the Islands, and the furtherance of the campaign of education as to the value and necessity of practicing forestry in these islands by the publication of bulletins which will present to the public knowledge on this subject, and by the giving of personal advice and assistance. For all of these lines of work during the coming biennial period we recommend that adequate provision be made by the Legislature.

The report of the Superintendent of Forestry and, after his departure, of the Acting Superintendent, cover in detail the matters here merely outlined. They are followed by the report of the Forest Nurseryman and by a list of the present District Fire Wardens.

DIVISION OF HYDROGRAPHY.

The creation of this division was authorized by the 1913 Legislature, and it began its work under the Board on July 1, 1913. Previous to this date the hydrometric work of the Territory was carried on under the direction of the Superintendent of Public Works in cooperation with the U. S. Geological Survey. During the period covered by this report, this cooperation with the U. S. Geological Survey has continued and the Territory has thereby benefited financially to some extent. The hydrometric work which this division has performed during the past period amply justifies Act 57 of the 1913 Legislature, which appropriately provided for the work of the division one-half of the revenues derived from water licenses. The other half was apportioned to the Division of Forestry, and thus the revenue from the forests was put back on these same forests by the activities of these two divisions of the Board.

When it is realized that at least 15 years of continuous records of the flow of a stream are necessary to obtain a close estimate of the extreme low and flood discharge, it is apparent that this work for the Territory, where water is considered such a valuable asset, has been started none too soon.

SCOPE OF WORK.

The results worked for by this division primarily are an accurate knowledge of the total fresh water resources of the Territory, a knowledge of the amounts diverted from both private and government sources, the efficiency of such diversions, and a knowledge of the possible future development and utilization of water now being wasted. To obtain these results the constructive stage or the more expensive stage during which equipment must be established under adverse conditions, must be passed through before the operative stage at less cost and on a smaller organization can be reached. The construction work for the islands of Kauai, Oahu, and Maui is now more than half completed, and has been closely followed by maintenence work. All of the larger and most valuable streams and springs have been investigated and although in the spring of 1914 it became necessary to curtail the work at the request of the Governor, the hydrometric work in the Territory may be said to be well begun.

UTILIZATION INVESTIGATIONS.

Enough progress has been made in the work of measuring utilized water in ditches, flumes, etc., to show that there has been great variation in the rentals received from both government and private water, and that this subject should receive further attention. Work of this nature was performed at the substation of the Hawaiian Sugar Planters' Association at Waipio, Oahu, and will be continued on eight different plantations, the expenses incident to these investigations being borne by the plantations.

COOPERATIVE WORK.

Under a similar arrangement much cooperative work has been done for private corporations and the U. S. Army on Oahu. This has consisted of water measurements at Schofield Barracks, the establishment of 25 measurement stations at Kailua, Kaneohe and Heeia, other stations at Kahuku, Laie and Wahiawa, of which some were to determine whether the storage of flood water is justified, and one in the Waiahole Tunnel. Much data on stream runoff and rainfall has also been supplied by private sources, and these with data secured by cooperation will be published in public documents.

OTHER INVESTIGATIONS.

An investigation of the utilization of all water in the Honolulu basin was begun in November, 1914. The investigation of the surface water resources of North and South Kona, Hawaii, required by Act 102 of the 1913 Legislature, was completed at a cost of $3,073.00, and the printed report will be ready for the coming Legislature. Continuous record measurement stations have been established above the 700 feet level to determine the discharge of a group of five streams on windward Kauai, and to confirm the apparent possibility of delivering the waters of these streams to the plantations and homesteads of leeward Kauai by a gravity system at a much cheaper rate per million gallons than that which is now paid for pumping operations. The development of such a project would increase territorial revenues since two of the streams are owned by the government. A special type of rain gage which can be read at monthly or bi-monthly intervals has been designed and installed on high ridges and other rather inaccessible localities.

The results of the investigations of this division are available for the public at all times, and upon request blue print copies of data pertaining to any stream, ditch or locality for which information is desired are mailed or furnished to applicants.

STAFF.

The work of this division has been in charge of Mr. G. K. Larrison, Superintendent of Hydrography, who is also Special Disbursing Agent for federal funds contributed to hydrometric work in the Territory. He has been assisted by Mr. J. C. Dort, Engineer in Charge on Kauai, Mr. C. T. Bailey, Engineer in Charge on Maui; Mr. H. Kimble, Engineer in Charge of Construction and by Mr. H. A. R. Austin, Junior Engineer, both on Oahu.

RECOMMENDATIONS.

Since the hydrometric investigations of this division are of undisputed value to the Territory the Board heartily recommends their continuation under the same organization and arrangement. To carry on this work, the Board recommends that appropriate funds be provided by the Legislature. The Board also makes the additional recommendation that the underground water investigation, which is at present conducted under the direction of the Department of Public Works, be consolidated on July 1, 1915, with the present hydrographic investigations of this division, because it is believed that the two sources of water supply may be investigated more efficiently under one head.

The report of the Superintendent of Hydrography covers in detail the matters here outlined, and appended thereto is a list of stream, ditch, and rainfall gaging stations.

DIVISION OF ENTOMOLOGY.

As in the past, the most important work of this division during the last two years was insect control by a rigid inspection of all agricultural and horticultural products shipped into the Territory from the mainland and foreign countries. Other activities, also of great importance, were the inter-island inspection to prevent insects and other pests from being carried from one island to another and the discovery, introduction, propagation and distribution of several parasites of the Mediterranean fruit fly, the horn fly and other insect pests. In addition to the above, advice was given on methods of controlling or eradicating bothersome household, horticultural and other insect pests.

INSPECTION OF IMPORTS.

The report of the Superintendent of Entomology points out in detail the difficulties encountered in preventing injurious insect pests from being surreptitiously introduced into the Territory, and it is a great satisfaction to report that during the past biennial period, in which there was a decided increase in the importation of horticultural products, due partly to the initial opening of the Panama Canal, no injurious insect, not already established in these islands to the knowledge of this Division, found its way into the Territory, but that by this rigid inspection many injurious pests of other countries were discovered and destroyed.

At the ports of Honolulu and Hilo, the Superintendent and his assistants during the last two years boarded and inspected 1113 vessels, and found that 681 of these carried 628,725 packages of vegetable matter which required inspection. This is an increase of 122 vessels boarded and of 125 vessels bearing vegetable matter over the numbers in the previous biennial period. Of the total number of packages inspected, 606,222, or over 96 per cent, consisted of fruit and vegetables imported from the mainland as food for home consumption. The remainder consisted of seeds and plants. This is an increase of 143,736 over the total number of packages inspected during the previous two years. Of this total number of packages it was found that less than 3 per cent required treatment on account of infestation by insect pests or plant diseases, as follows: 1,777 packages were destroyed by burning, 14,521 were fumigated before delivery, and 776 were returned to the shipper.

One direct result of this careful inspection during the past biennial period was the improvement in the quality of fruit imported from the Pacific Coast and its shipment in a cleaner condition.

The importation of rice and beans from the Orient is increasing annually and it has been necessary to inspect all such shipments for the rice weevil, already existing in the Territory, and for the rice moth, not yet introduced. Although all rice shipments destined here are first fumigated in Japan, there is danger of infestation on the voyage from non-fumigated shipments, on the same vessel, destined to the coast. It is necessary, therefore, to continue this inspection of Oriental rice and beans. During the past biennial period only 3,400 bags of rice out of a total shipment of 602,375 bags, and only 162 bags of beans out of 3,400 bags had to be fumigated on account of infestation by the rice moth. This pest on bean shipments was first noticed in 1913, and at the request of the Superintendent of Entomology beans were at once included in the fumigation order in Japan. Several shipments of rice and beans from Japan were made direct to Hilo during the last two years, and inspection found these fortunately to be free from pests. A careful watch has also been kept for importations of sugar cane which are apt to bring new and destructive pests into the Territory. Fortunately, none have, in this manner, appeared during the last two years.

EQUIPMENT.

Inspection equipment at the port of Honolulu has been further improved during the past biennial period so that now this division is prepared, with its fumigation apparatus, to handle almost any size of infested shipment. An efficient and economical fumigating house was erected in 1913 on Kilauea Street, near Pier 7, where most of the Oriental cargoes are landed, and with the assistance of the Harbor Commissioners the inspectors' office on this pier has been enlarged and made more commodious. It remains to improve the fumigating facilities at Hilo, where direct shipments of rice and beans as well as other horticultural products are now received, and this it is planned to do as opportunity presents itself.

INTER-ISLAND INSPECTION.

To supplement inspection of foreign and mainland importations, and to prevent pests which might accidentally come to Honolulu from being carried to other islands, the inspection of inter-island shipments has been continued. In this work 1,438 steamers sailing from Honolulu to other islands were attended to and 23,906 packages examined. Of these, 5,136 packages consisted of plants, mostly nursery stock growing in sterilized soil, 18,116 packages consisted of vegetables, mostly taro for poi making, and the remaining 654 packages contained, for the most part, fruit imported from the mainland. Of the total number of packages inspected, only 668 or less than 3 per cent were refused shipment on account of infestation or attached soil which was questionable.

In order to prevent its spread to other islands of a pineapple disease which first appeared on Kauai in 1913 and then on Oahu, Rule XVIII was made and amended to prevent the carrying of pineapple fruit, plants, or suckers from these two islands to any other in the group.

FRUIT FLY CONTROL.

The work of the Board in this direction has been entirely confined to the search, introduction, breeding and distribution of parasites of the Medditteranean fruit fly, and to the organization of this work Mr. W. M. Giffard was fortunately able to devote considerable time and render special and valuable service. The results of the two successful expeditions to Africa for parasites of the fruit fly are already most promising. Two parasites are already known to be definitely established and in many districts the noticeable checking of the ravages of this pest is already quite apparent. After the clean culture campaign was taken over by Federal officials with Territorial cooperation, and later abandoned because it did not produce the desired results and conflicted with the natural establishment of parasites, the Board continued cooperation with the Bureau of Entomology, represented locally by Dr. E. A. Back, who has carried on incidental investigations concerning the percentage of parasitism while undertaking in the main other general observations as to the life history, etc., of the fruit fly from material collected in the field. Dr. Back's appended report on the percentage of parasitism of the newly introduced parasites of the fruit fly will be found of great interest and will to some extent show how successful the introduction and distribution of parasites has been. The Board takes this opportunity to thank Dr. Back for the information contained in this report.

The results of the first expedition to Africa searching for parasites of the fruit fly by Prof. F. Silvestri, who, after a seven months' search, was successful in reaching Honolulu with three larval and two pupal parasites of the fruit fly, and an account of their breeding and distribution up to December 31, 1913, are contained in Bulletin No. 3 of this division which was issued early in 1914. The success and experiences gained by this first expedition, which paved the way to further search, led the Board to undertake a second expedition to Africa. Therefore, in June, 1914, since Prof. Silvestri could not be obtained for this work because his services were needed by the Italian government, Messrs. D. T. Fullaway and J. C. Bridwell were commissioned and started for the West Coast of Africa, arriving at Lagos, Nigeria, on July 24, 1914. Mr. Fullaway returned to Honolulu on October 27, 1914, with live specimens of four different kinds of parasites on the fruit fly. Three of these have been successfully bred and multiplied, and have been liberated on three of the islands. For a full account of this second expedition and of the gratifying results achieved thereby and of breeding experiments, you are referred to the appended interesting report by Mr. Fullaway. Mr. Bridwell is still in South Africa multiplying the parasites secured in Nigeria and investigating the field in that region.

Prof. Silvestri, in his first expedition, also brought back a dung fly parasite, which with two others brought from the Philippines by Mr. Fullaway early in 1914 have been multiplied in large numbers in the insectary and liberated in stables about Honolulu and on all the large cattle ranches on all the islands. During the first half of 1914 several consignments of beetles which are predatory on the dung fly were received from Prof. Silvestri, bred and distributed, as well as a beetle which feeds on the mealy bug, which Mr. Fullaway also brought back from the Philippines.

FEDERAL HORTICULTURAL BOARD.

The Superintendent of Entomology has continued to be a collaborator of the Federal Horticultural Board, and two of his assistants have recently been similarly appointed to supervise inspection under the recent Federal plant quarantine act and to require compliance with the rules and regulations issued under that act. The additional powers received by these inspectors in this manner have materially assisted in regulating the landing of the unlisted small package brought in by passengers and many plants gathered by the travelling public at random and packed in every kind of soil, moss, or other objectionable material have been intercepted. By these Federal regulations the danger of sending in infested seed from foreign countries through the mails has also been obviated, and along those lines the division has worked in close cooperation with the Post Office Department. A synopsis of the plant quarantine regulations passed by the Federal Horticultural Board is contained in the report of the Superintendent of Entomology, which, with other reports, also discusses in detail the matters here outlined.

STAFF.

Mr. E. M. Ehrhorn has continued as the Superintendent of Entomology in charge of the Division, and, as stated above, the parasitic work has received the personal attention and care of Mr. W. M. Giffard throughout more than half of the biennial period. Assistant Inspector D. B. Kuhns has been aided in the inspection work on the Honolulu wharves by three assistants and there have been two assistants in the entomological laboratory and insectary. Brother Matthias Newell has, continued as inspector at Hilo, and at other ports in the islands six gentlemen have generously served as honorary inspectors. On June 3, 1913, Mr. J. C. Bridwell was appointed Assistant Superintendent of Entomology, and he assisted Mr. D. T. Fullaway in the insectary until the latter made his trip to the Philippines, when Mr. Bridwell took charge of the insectary work. Mr. Bridwell's appointment was changed to Assistant Field Entomologist on July 1, 1914, to assist Mr. Fullaway in the African expedition until its termination. Prof. Silvestri reached Honolulu from his first expedition to Africa on May 16, 1913, and further served the Board until July 31, 1914, when his services could no longer be obtained. The services of Mr. D. T. Fullaway were obtained as Special Collaborator from the Hawaii Experiment Station to assist Prof. Silvestri in breeding parasites on his arrival from the first expedition. After Prof. Silvestri's departure for Italy on June 13, 1913, Mr. Fullaway was in charge of this work until October of the same year, when he went to the Philippines on research work for the Federal Government. On June 1, 1914, after his return from the Philippines, Mr. Fullaway was appointed Field Entomologist, and was in charge of the second expedition to Africa. Since his return to Honolulu on October 27, 1914, he has continued to be engaged in the breeding and distribution of the parasites which he brought back with him.

RECOMMENDATIONS.

The continuation of the work of plant quarantine inspection is of particular importance now that, with the opening of the Panama Canal, the Territory will be in special danger from infestation, particularly of sugar cane pests, from Central and South America, and Mexico. This, with the increase of shipments from the Orient (an important source of infestation), and the mainland, and the necessity of watching cargoes in transit on vessels which make Honolulu a port of call will require an adequate appropriation for inspection work to keep new pests out of the Territory and prevent pests from being carried from one island to another.

The introduction of parasites of the Mediterranean fruit fly has now progressed so satisfactorily that for the present no further search abroad for additional parasites on the fruit fly seems necessary. The damage done to the crops of small farmers and horticulturists, however, by the melon fly, Japanese beetle, pink cotton boll worm, alligator pear mealy bug, and corn leaf hopper makes it imperative that natural enemies of these pests be secured to reduce the losses they cause. The Board, therefore, recommends that a substantial appropriation be made for the search, introduction, propagation, and distribution of such natural parasites and predaceous insects as would tend to control the pests named above.

DIVISION OF ANIMAL INDUSTRY.

The main work of this division during the past biennial period has continued to be the careful inspection of all live stock importations to prevent new animal diseases from being introduced into the Territory, and the prosecution of the campaign for the eradication of the live stock diseases that are already here.

The inspection has still been successful in keeping out of the Territory devastating animal scourges such as the Texas fever, rabies, anthrax, black leg, foot and mouth disease, which annually cost the United States and foreign countries millions of dollars, and the efforts of the division have been rewarded by a marked decrease in the ravages of diseases which gained an entrance here before the work of this division began.

LIVE STOCK CONDITIONS IN GENERAL.

The past two years have been, in most respects, favorable to the live stock interests throughout the Territory. The prolonged drought which ended in the summer of 1913 did not cause such great losses as in the past, although feed on the ranges became very short, because of the improved conditions of water supply in nearly all of the stock breeding districts. The increased consumption of beef and other meats due to the presence of the army stationed here, still necessitates the importation of large amounts of beef and mutton, so that there is no lack for a market for island products of this nature.

The sheep industry in the Territory has been reduced considerably in favor of cattle raising, and horse and mule breeding has received a great impetus on account of the demand for locally raised animals for all branches of the military service stationed here.

No epidemic of any kind has occurred among either cattle or sheep, but hog cholera has again appeared with sufficient loss to require once more the importation of butcher hogs from California. The health of horse stock may be said to have never been better. Glanders has been practically eradicated from the Territory, and there have been only a few scattered cases of spinal meningitis.

IMPORTATION OF LIVE STOCK.

During the past biennial period the importation of pure bred registered breeding stock has continued as in the past, and the result has been a vast improvement in the quality of live stock production. As compared with the previous biennial period, there has been a slight falling off during the last two years in the importation of horses, mules and sheep, a considerable falling off in the number of dogs brought in, due no doubt to the quarantine regulations, but there has been a marked increase in the amount of poultry imported and in the number of swine brought in, the latter due to the decimating effects of hog cholera and the increased demand for pork.

As pointed out in the report of the Superintendent of Animal Industry, the results of the importation of pure bred stock during the last ten years has been amazing, the efforts of one ranch company alone resulting in doubling the total value of all live stock in the islands. Horse stock has been improved so that the Territory can now supply to the military island-bred horses fully up to stringent army requirements, and success has been attained in developing by careful breeding methods mules of large size, the animals so useful in the sugar industry.

DISEASES OF LIVE STOCK.

As previously stated, there has been no epidemic among cattle or sheep during the past two years. The health of horses has generally been excellent. A few scattered cases of spinal meningitis have occurred, but there has been no recrudescence of glanders, such as the outbreak in Waipio Valley, Hawaii, in 1912, with the exception of one or two doubtful cases. Sheep scab in the Territory is well under control, and, thanks to the dog quarantine regulation passed by the Board in 1912, rabies is still unknown in the Territory. For the first time in four years a considerable number of hogs were lost by cholera, which reappeared in a mild form from infection already here. Soon after the outbreak was discovered it was put under control, but to prevent the spread of the disease to other islands the Board passed Rule VII of the Division of Animal Industry. This was approved by the Governor on July 10, 1913 and prevents the shipping of hogs from Oahu to other islands, and provides for the observation of hogs imported from abroad.

BOVINE TUBERCULOSIS CONTROL.

This work, as in the past, has continued to occupy a large share of the attention of the Division, and the results of improvement in this direction during the past two years have been most gratifying. It is therefore a pleasure to announce a reduction in the numbers of animals affected with this disease, which is a source of human infection. In 1913 a test of 4,444 head of cattle showed that less than 2.67 per cent, and in 1914 a test of 7,231 head showed that only 2.08 per cent was infected. Some of these were range cattle, but almost all reactors have been destroyed without indemnification, or segregated so as to prevent further infection. So far as Oahu is concerned, it is now extremely doubtful whether any milk from tuberculous animals ever reaches a milk consumer, and a similar amelioration of conditions on most of the other islands has resulted from the faithful efforts of the deputy territorial veterinarians. This statement is supported by the Territorial Board of Health records, which show a reduction in the prevalence of tuberculosis among children in the County of Honolulu of 75 per cent since the beginning of this campaign, or rather since all the extensively affected animals have been destroyed.

Fortified with the success obtained to date in the control of bovine tuberculosis, it would be very inopportune now not to make the final effort of complete eradication of this disease in cattle, and thus remove this source of danger to humanity. All that is asked to make this worthy attempt complete is a sufficient appropriation to cover a few added testing facilities, and the payment of indemnification to private owners of all new cases developing in already tested and cleaned herds. The cooperation of the County of Honolulu with the Board in its effort to insure the delivery of pure milk to the public has not been satisfactory during the past two years, and it is hoped that the Legislature will take steps to rectify the matter.

In connection with the importation of live stock the Board has not alone guarded against the introduction of infected animals, but has made every effort to facilitate the importation of valuable breeding animals with as little cost and inconvenience as possible. To this end two ports of entry besides Honolulu were provided in 1913 with quarantine stations. These were at Hilo, Hawaii, where a suitable station was erected at a cost of a little less than $3,000, and at Kahului, Maui, where the new station cost about half as much. Both are of solid construction, and absolutely modern as to sanitation and hygiene as well as to comfort and convenience. The quarantine station at Honolulu has continued to serve its usefuless and here also all dogs imported into the Territory have to undergo quarantine. Canine introductions have dropped from 240 during the years 1911 and 1912 to 127 during the last biennial period.

STAFF.

There has been no change in the staff of the Division of Animal Industry during the past two years, but Mr. J. Richards as live stock inspector has assisted for three-quarters of the period in the intra-dermal tests of cattle and in other ways. The Deputy Territorial Veterinarians on Hawaii, Maui and Kauai have continued with small remuneration to render valuable assistance to the Territory. Their reports, as well as those of the Territorial Veterinarian and his assistant cover in detail the points here outlined.

RECOMMENDATIONS

The success so far obtained in the control of animal scourges in the Territory should be followed up at once in the final effort to eradicate them, and for this purpose the Board specifically recommends:

(1). That sufficient appropriation be made for the strengthening of the live stock sanitary service throughout the Territory by the payment of adequate salaries and travelling expenses to the deputy territorial veterinarians.

(2). That an appropriate sum of money be provided for reimbursing the owners of tuberculous dairy cattle destroyed for the protection of public health and of horses destroyed in the eradication of glanders.

(3). That milk inspection be placed under territorial auspices so that better cooperative work can be accomplished.

CONCLUSION.

In submitting this report, the Board again desires to call attention to the fact that the organization of the Board does not include purely agriculural work among its functions. This has been left to the Federal Agricultural Experiment Station, with the result of saving money for the Territory. The work of the Divisions of Forestry, Hydrography, Entomology and Animal Industry of this Board has been purely practical, and educational work has been left to the College of Hawaii.

The experience of the Board in the past has shown that the executive work of the Board as a whole cannot satisfactorily be controlled without a paid executive who could devote more time to this work than the members of the Board have at their disposal. The Board therefore recommends that a change be made in the law which will facilitate this control.

In conclusion, the Board takes pleasure in calling attention to the detailed reports and various recommendations of the Divisions of Forestry, Hydrography, Entomology and Animal Industry, and it is satisfied that each is not only rendering practical and efficient service now to the inhabitants of the islands but is also accomplishing work which is and will be a lasting benefit to the Territory as a whole. For the continuation of these lines of work it is hoped that the Board and its four divisions will receive adequate support, both financially and otherwise.

Respectfully submitted.

ALBERT WATERHOUSE,
Acting President and Executive Officer.
W. M. GIFFARD,
J. M. DOWSETT,
A. H. RICE,
H. M. VON HOLT,
Commissioners.

ALLOTMENTS AND EXPENDITURES.

BOARD OF AGRICULTURE AND FORESTRY.

For the Biennial Fiscal Period, Jan. 1, 1913—Dec. 31, 1914.

GENERAL FUND.

January 1, 1913, to December 31, 1914.

Allotments.

Jan. 1, 1913—Balance on hand	$28,711.20	
July 1, 1913—Allotment under the terms of Act 164, S.L., 1913, of a portion of Special Income Tax	88,488.00	
Oct. 17, 1913—Allotment under the terms of Act 164, S.L. 1913, of a portion of Special Income Tax	29,040.63	
“ “ “ —Allotment under the terms of Act 164, S.L., 1913, of a portion of Special Income Tax (Interest)	991.97	
Dec. 1, 1914—Allotment under the terms of Act 164, S.L., 1913, of a portion of Special Income Tax	16,038.62	
“ “ “ —Allotment under the terms of Act 164, S.L., 1913, of a portion of Special Income Tax (Interest)	621.79	
Total amount available for 24 months period, Jan. 1, 1913, to Dec. 31, 1914		$163,892.21

Summary of Expenditures.

Amount expended to June 30, 1913	$22,284.60	
“ “ May and June, 1913 for Division of Forestry	2,173.10	
” ” July 1, 1913, to June 30, 1914, 12 months	41,631.87	
“ “ July 1, 1914, to Dec. 31, 1914, 6 months	20,196.83	
Grand total of expenditures for 24 months, Jan. 1, 1913, to Dec. 31, 1914	86,286.40	
Amount lapsed June 30, 1913	4,253.50	
		$90,539.90
Unexpended balance, Dec. 31, 1914		$73,352.31

STATEMENT OF EXPENDITURES.

General Board	1913	1914	1913-14		Total expenses and pay rolls, 1913-14.
Including Administration for all Divisions.					
Current Expense.					
Routine	$ 333.51	$321.91	$655.42		
Publications	2,432.40	538.30	2,970.70		
Advertising	254.92	.....	254.92		
Stationery and Office Supplies	356.97	320.72	677.69		
Library	724.63	42.74	767.37		
Travel	639.31	34.65	673.96		
Incidentals	2,236.83	916.41	3,153.24		
Repairs	1,717.95	224.66	1,942.61		
New Buildings	683.18	.....	683.18		
Total	$9,379.70	$2,399.39	$11,779.09	$11,779.09	
Pay Rolls.					
Salary, Clerk and Stenographer	$1,800.00	$1,800.00	$3,600.00		
Pay of Assistants, Employees and Laborers	2,854.45	2,160.00	5,014.45		
Total	$4,654.45	$3,960.00	$8,614.45	$8,614.45	$20,393.54
Forestry Division.					
Current Expense.					
Nurseries, Oahu	$419.80				
" Hawaii	60.00				
" Kauai	87.95				
Travel	333.27				
Incidentals	273.51				
Total	$1,174.53			$1,174.53	

Pay Rolls.					
Salary, Superintendent	$1,500.00				
Pay of Assistants, Employees and Laborers	2,803.79				
Total	$4,303.79			$4,303.79	$5,478.32
Entomology Division.					
Current Expense.					
Inspection Expense, Oahu	$772.87	$132.75	$905.62		
" " Other Islands	5.25	124.00	129.25		
Travel	500.13	472.78	972.91		
Laboratory Supplies	259.07	579.57	838.64		
Incidentals	267.64	1,199.69	1,467.33		
Parasitic Work	920.58	3,359.55	4.280.13		
Total	$2,725.54	$5,868.34	$8,593.88	$8,593.88	
Pay Rolls.					
Salary, Superintendent	$3,000.00	$3,000.00	$6,000.00		
Pay of Assistants, Employees and Laborers	8,104.50	11,104.00	19,208.50		
Total	$11,104.50	$14,104.00	$25,208.50	$25,208.50	$33,802.38
Animal Industry Division.					
Current Expense.					
Dog Quarantine	$448.38	$6.35	$454.73		
Travel	2,056.49	1,074.81	3,131.30		
Laboratory Supplies	38.50	77.67	116.17		
Quarantine Station, Honolulu	920.48	1,109.55	2,030.03		
" " Hilo	95.71	.....	95.71		
" " Kahului	17.75	1.00	18.75		
Tuberculosis Control	209.77	345.30	555.07		
Incidentals	94.80	201.25	296.05		
Total	$3,881.88	$2,815.93	$6,697.81	$6,697.81	

STATEMENT OF EXPENDITURES.

	1913	1914	1913-14		Total expenses and pay rolls, 1913-14.
Pay Rolls.					
Salary, Superintendent	$3,000.00	$3,000.00	$6,000.00		
Pay of Assistants, Employees and Laborers	6,748.85	7,165.50	13,914.35		
Total	$9,748.85	$10,165.50	$19,914.35	$19,914.35	$26,612.16
Grand Total, Expenditures for two years					$86,286.40

WATER LICENSE FUND.

(By authority of Act 57, Session Laws of 1913.)

July 1, 1913, to Dec. 31, 1914.)

FORESTRY DIVISION.

Allotments.

July 1, 1913, half of $33,000.00	$16,500.00	
May 1, 1914, half of $33,000.00	16,500.00	
Sept. 25, 1914	10,000.00	
Total amount allotted, 18 months, July 1, 1913, to Dec. 31, 1914		$43,000.00
Expenditures for 18 months, July 1, 1913, to December 31, 1914		27,591.08
Unexpended balance Dec. 31, 1914		$15,408.92

STATEMENT OF EXPENDITURES.

FORESTRY DIVISION.

July 1, 1913, to December 31, 1914.

	6 mos. 1913.	12 mos. 1914.	18 mos. 1913-14.		Total expenses and pay rolls
Current Expense.					
Nurseries, Oahu	$76.99	$230.55	$307.54		
" Other Islands	95.75	185.20	280.95		
Travel	462.91	878.66	1,341.57		
Incidentals	506.71	439.56	946.27		
Fence Contracts	227.25	3,421.79	3,649.04		
Extermination Wild Stock	.....	20.25	20.25		
Forest Planting	.....	375.91	375.91		
Arbor Day	.....	69.20	69.20		
Honolulu Watershed	123.07	36.32	159.39		
Forest Fires	11.70	.....	11.70		
Total	$1,504.38	$5,657.44	$7,161.82	$7,161.82	
Pay Rolls.					
Salary, Superintendent	$1,500.00	$2,000.00	$3,500.00		
Forestry, Wages and Labor	2,000.00	4,374.83	6,374.83		
Nurseries, Oahu	1,146.00	2,507.00	3,653.00		
" Other Islands	443.00	885.50	1,328.50		
Honolulu Watershed Planting	800.43	2,570.90	3,371.33		
Forest Planting, Other Islands	621.75	1,579.85	2,201.60		
Total	$6,511.18	$13,918.08	$20,429.26	$20,429.26	
Grand Total, Expenditures for 18 months, July 1, 1913, to Dec. 31, 1914					$27,591.08

WATER LICENSE FUND.

(By authority of Act 57, Session Laws of 1913.)

July 1, 1913, to Dec. 31, 1914.)

HYDROGRAPHY DIVISION.

Allotments.

July 1, 1913, half of $33,000.00	$16,500.00	
Jan. 31, 1914, half of $33,000.00	16,500.00	
Sept. 14, 1914, Realization	151.62	
" 25, 1914, Allotment	3,500.00	
" 25, 1914, Realization	125.00	
Dec. 31, 1914, "	100.00	
Total amount allotted, 18 months, July 1, 1913, to Dec. 31, 1914		$36,876.62
Expenditures for 18 months, July 1, 1913, to Dec. 31, 1914		36,734.18
Unexpended balance, Dec. 31, 1914		$142.44

STATEMENT OF EXPENDITURES.

HYDROGRAPHY DIVISION.

July 1, 1913, to December 31, 1914.

	6 mos. 1913.	12 mos. 1914.	18 mos. 1913-14		Total expenses and pay rolls 1913-14
Current Expense.					
General Office Expense	$443.32	$850.65	$1,293.97		
Subsistence of Persons, etc.	1,265.44	1,688.34	2,953.78		
Travel Charges	485.40	1,154.02	1,639.42		
Equipment, permanent	3,278.81	2,468.63	5,747.44		
Supplies expendable	2,768.39	2,194.72	4,963.11		
Incidentals	302.32	744.36	1,046.68		
Labor	990.90	2,156.61	3,147.51		
Total	$9,534.58	$11,257.33	$20,791.91	$20,791.91	
Pay Rolls.					
Stream Gaging	$2,924.17	$3,203.97	$6,128.14		
Rain Gaging	264.25	198.20	462.45		
Trail Construction	550.71	261.00	811.71		
Reports, Editing, etc.	1,573.38	2,435.09	4,008.47		
General Office Expense	626.14	1,480.48	2,106.62		
Annual or Sick Leave	100.75	681.53	782.28		
General Supervision	710.60	932.00	1,642.60		
Total	$6,750.00	$9,192.27	$15,942.27	$15,942.27	
Grand Total, Expenditures for 18 months, July 1, 1913, to Dec. 31, 1914					$36,734.18

SPECIAL FUND.

FORESTRY DIVISION.

"Special Fund on Deposit" now under heading "Preservation and Extension of Forestry and Forest Reserves.'

January 1, 1913, to December 31, 1914.

Receipts.		
Balance, Dec. 31, 1912	$2,955.00	
Amount received to Dec. 31, 1914	182.50	
		$3,137.50
Expenditures:		
Labor cutting and splitting fence posts on Tantalus for use in cooperative experiment..		81.00
Unexpended balance Dec. 31, .1914		$3,056.50

SPECIAL APPROPRIATIONS.

January 1, 1913, to December 31, 1914.

Combatting Mediterranean Fruit Fly.		
Balance, Dec. 31, 1912		$1,864.63
Expenditures:		
Current Expense	$53.10	
Pay Rolls	236.50	
		289.60
Amount lapsed June 30, 1913		$1,575.03
Hawaii Inspection, Fruit Fly.		
Balance, Dec. 31, 1912		$1,485.15
Expenditures:		
Current Expense	$32.50	
Pay Rolls	1,021.50	1,054.00
Amount lapsed June 30, 1913		$431.15
Maui Inspection, Fruit Fly.		
Balance, Dec. 31, 1912		$1,000.00
Expenditures:		
Current Expense	$46.50	
Pay Rolls	....	46.50
Amount lapsed June 30, 1913		$953.50

Parasites, Fruit Fly and Boll Worm.

Balance, Dec. 31, 1912		$1,811.43
Expenditures:		
Current Expense	$31.20	
Pay Rolls	950.00	981.20
Amount lapsed June 30, 1913		$830.23

Planting and Fencing Kohala Forest Reserve.

Balance, Dec. 31, 1912		$1,447.25
Expenditures		
Amount lapsed June 30, 1913		$1,447.25

Construction of Animal Quarantine Stations (Hilo and Kahului).

Balance, Dec. 31, 1912		$4,000.00
Expenditures:		
Plans and advertising	$56.50	
Hilo Station (contract)	2,800.00	
Kahului Station (contract)	878.98	3,735.48
Amount lapsed June 30, 1913		$ 264.52

Plant Inspection Other Islands.

Balance, Dec. 31, 1912		$1,472.20
Expenditures:		
Current Expense	$30.10	
Pay Rolls	810.00	840.10
Amount lapsed June 30, 1913		$ 632.10

HYDROGRAPHY DIVISION.

WATER INVESTIGATION NORTH AND SOUTH KONA.

(By authority of Act 102, Session Laws of 1913.)

Allotments.

July 1, 1913—Amount made available	$3,000.00
Expenditures for 18 months, July 1, 1913, to Dec. 31, 1914	2,896.51
Unexpended balance, December 31, 1914	$ 103.49

STATEMENT OF EXPENDITURES.

HYDROGRAPHY DIVISION.

WATER INVESTIGATION NORTH AND SOUTH KONA.

July 1, 1913, to December 31, 1914.

	6 mos. 1913.	12 mos. 1914.	18 mos. 1913-14.		Total expenses and pay rolls 1913-14
Current Expense.					
General Office Expense	$38.00	.....	$38.00		
Subsistence, Persons, etc.	342.65	15.50	358.15		
Equipment Permanent	596.93	.....	596.93		
Supplies Expendable	145.85	8.05	153.90		
Travel Charges	224.25	45.50	269.75		
Incidentals	50.78	19.00	69.78		
Total	$1,398.46	$88.05	$1,486.51	$1,486.51	
Pay Rolls.					
Stream Gaging	$149.38	$41.00	$190.38		
Rain Gaging	365.45	234.00	599.45		
Report, Compiling, etc.	74.25	90.00	164.25		
General Office Expense	21.25	.....	21.25		
Field Investigation, etc.	354.67	80.00	434.67		
Total	$965.00	$445.00	$1,410.00	$1,410.00	
Grand Total, Expenditures for 18 months, July 1, 1913, to Dec. 31, 1914					$2,896.51

Division of Forestry

Report of the Superintendent of Forestry

Honolulu, Hawaii, August 31, 1914.

The Board of Commissioners of
Agriculture and Forestry,
Honolulu, Hawaii.

Gentlemen:—I have the honor to submit as follows the report of the Division of Forestry for the period from January 1, 1913, to August 31, 1914. This report is made at this time and to this earlier date instead of as usual to the end of the calendar year because of my resignation as Superintendent of Forestry, which takes effect on September 1, when I leave the Territory to become head of the Department of Forestry at Cornell University.

SCOPE OF THIS REPORT.

After the custom of past years this report recounts briefly the activities of the Division of Forestry for the current period. Accompanying it is a revised table giving the essential statistics regarding the established forest reserves. Together with this biennial statement it has seemed to me appropriate, as this is my last report as Superintendent of Forestry, to summarize what I conceive to have been the main accomplishments in forestry work in Hawaii during the past decade, the period since the establishment of the Division of Forestry, and to make certain recommendations as to the principles which I believe should guide forest work in Hawaii in the future. The statement concerning the years 1913 and 1914 precedes the general summary.

RESUME OF THE WORK PERFORMED.

The work of the Division of Forestry during this year and last has followed closely the lines laid down in earlier periods. Protection of the native Hawaiian forests on the important watersheds and encouragement of tree planting to meet divers demands under various conditions, have remained the two dominant ideas that have guided its activities. Further repetition of the reasons for practicing forestry in Hawaii seems unnecessary, but the need itself is a continuing one and will always remain so. The economic life of the Territory rests on the tripod of the three essential natural resources of the islands—water, forests and lands. To make the most complete use of the land there must be water, and to insure a permanent and adequate supply of water there must be forests. No one of the three can be spared from the foundation. And, scarcely less important, the forests cannot properly be protected and cared for without men trained in the principles and practice of forestry. Forests and forest work form an integral part of the local economic structure, which in turn supports our whole social organization. Forestry is therefore one of the fundamental needs of Hawaii.

STAFF.

No changes have been made in the salaried staff of the Division of Forestry in the past twenty months. As in former years the active work of the Division has been divided between the Superintendent of Forestry (Ralph S. Hosmer), who as well as having general charge of all its activities, has devoted particular attention to forest reserve matters, including fence construction, and the Forest Nurseryman (David Haughs), under whose immediate direction comes the propagation and distribution of seedling trees and other plant material and the answering of questions, verbal and by letter, of persons desiring advice and suggestions on various forest problems.

A few changes, mainly additions, have been made in the list of District Fire Wardens. A revised list of these volunteer officials accompanies this report.

The appropriation for the Division of Forestry for the present fiscal period consists of one-half of a special fund created by Act 57 of the Session Laws of 1913 from the revenues derived from water leases and licenses of streams on Government forest lands. On other pages of this report are statements showing how the money has been expended.

The Forest Nurseryman acts as Receiving Officer for the Board of Agriculture and Forestry. In his report will be found a statement of the realizations for 1913 and 1914.

FOREST RESERVES.

New Reserves.

During 1913 and 1914 ten new forest reserves have been added to the Forest Reserve system. The list is as follows:

NEW FOREST RESERVES.

Name	District	Island	Total Area	Area Gov't. Land.	Area Private Land.	Date 1913
Nanakuli	Waianae	Oahu	1,010	1,010	.....	June 4
Makua-Keaau	"	"	4,716	4,376	340	" 4
Kuaokala	Waialua	"	434	434	.....	" 4
Kohala Mountain	N. and S. Kohala	Hawaii	29,627	14,204	15,423	" 4
Upper Waiakea	Hilo	"	51,800	51,800	.....	Oct. 13
Upper Olaa	Puna	"	9,280	9,280	.....	" 13
Honolulu Watershed	Honolulu	Oahu	6,950	5,000	1,950	" 13
Total for the year 1913			103,817	86,104	17,713	
						1914
Kuliouou	Honolulu	Oahu	214	214	......	Feb. 13
Kipahulu	Kipahulu and Kaupo	Maui	10,600	4,600	6,000	Aug. 20
Olaa Forest Park	Puna	Hawaii	531	531	.....	" 20
Total for the year 1914			11,345	5,345	6,000	

On October 13, 1913, the boundary of the Moloaa Forest Reserve on Kauai was modified by the elimination of 83 acres and the addition of 34 acres, a net decrease of 49 acres. This action was taken on the basis of a revised survey to straighten the boundary line and exclude from the reserve a section of open land found not to be essential for water protection that was needed for grazing.

On August 31, 1914, there are 37 forest reserves in Hawaii with a total area of 748,214 acres, of which 546,222 acres (68 per cent.) is land belonging to the Territory. On following pages are tables giving the essential statistics of all the forest reserves to date.

Of new reserves the three set apart in June, 1913, are located on the leeward slopes of the Waianae Mountains on Oahu. The object in each case was to protect the scanty sources of water supply at the heads of the high valleys where even an intermittent supply of water has high value.

The Kohala Mountain Forest Reserve embraces the summit and southern slopes of Kohala Mountain. Protection of the watershed is its purpose in that from this mountain comes the water for the Kohala and the Hamakua Ditch systems as well as for the Waimea Plains. This reserve had long been pending. It was indeed one of the first suggested when the forest reserve policy was adopted.

Upper Waiakea and Upper Olaa together embrace a large tract of dense forested country in the region between Hilo and the Volcano. Although without running water it was felt that this section should be under the control of the Board of Agriculture and Forestry, particularly as in time the question may arise of exploiting the timber trees on the tract. These Government lands were accordingly set apart so that they might be handled by this Department.

The Honolulu Watershed Forest Reserve and its neighbor, the Kuliouou Forest Reserve, are both on the slopes of the Koolau Ridge back of the City of Honolulu. The name of the former is sufficiently indicative of its purpose; the latter was created for the protection of the stream in Kuliouou Valley.

The Kipahulu Forest Reserve on Maui, set apart in August, 1914, is likewise designed for watershed protection. It was practically the last large unreserved forest area in Hawaii needed to conserve a catchment basin. With its creation the forest reserve system throughout the Territory as regards watershed protection on Government lands may be regarded practically as technically complete, save for one land on Oahu, Mokuleia on the Waianae Hills.

On August 20, 1914, there were also set apart as the "Olaa

Plate 2. An Ohia Forest on Hawaii.

Forest Park Reserve," three areas of government land along the Volcano Road in the Puna District, Hawaii. The purpose here is to preserve in its primitive condition the most easily accessible remaining block of native Hawaiian forest in the Territory. Section A consists of a block of 374 acres of forest at 24 miles, a little above Glenwood. Section B is the small Koa grove at 29 miles, 7 1-3 acres. Section "C" comprises the so-called "forest strips" along the Volcano Road from 18 to 24 miles, area 150 acres. Both because of its scientific interest and because the forest along the Volcano Road is one of the scenic features of Hawaii, and hence a tourist attraction, it is deemed good business formally to set this land apart. It really constitutes a forest park rather than a forest reserve in the usual sense, but for purposes of administration and that the area may come under the Board of Agriculture and Forestry, this land was set apart as Forest Reserve No. 37.

FOREST RESERVES, TERRITORY OF HAWAII. Arranged in Chronological Order.

No.	Name	District	Island	Total Area Recommended to be Reserved.	Area Government Land.	Area Private Land.	Date of Proclamation	Proclamation Signed by
				Acres.	Acres.	Acres.		
1	Kaipapau	Koolauloa	Oahu	913	913	....	Nov. 10, 1904	G. R. Carter
2	Hamakua Pali	Hamakua	Hawaii	18,940	16,333	2,607	Dec. 23, 1904	"
	Total for the year ending December 31, 1904			19,853	17,246	2,607		
3	Hilo	Hilo	Hawaii	110,000	60,223	49,777	July 24, 1905	A. L. C. Atkinson
4	Koolau, Maui	Koolau and Hamakualoa	Maui	42,969	30,230	12,739	Aug. 24, 1905	"
5	Halelea	Halelea	Kauai	37,500	10,990	26,510	" " "	"
	Total for the year ending December 31, 1905			190,469	101,443	89,026		
6	Kealia	Puna	Kauai	9,935	7,385	2,550	Mar. 9, 1906	"
7	Ewa	Ewa, Waianae and Waialua	Oahu	28,550	5,151	23,399	" " "	"
8	Honuaula	Kona	Hawaii	665	665	.....	Apr. 4, 1906	"
9	Kau	Kau	Hawaii	†66,066	59,811	6,255	Aug. 2, 1906	G. R. Carter
10	Waianae-kai	Waianae	Oahu	‡ 3,653	3,546	107	Sept. 7, 1906	"
11	Lualualei	"	"	3,743	3,743	.....	Nov. 30, 1906	"
12	Hana	Hana	Maui	14,825	13,767	1,058	" " "	"
	Total for the year ending December 31, 1906			127,437	94,068	33,369		
13	Na Pali-Kona	Na Pali and Kona	Kauai	60,540	40,650	19,890	June 12, 1907	A. L. C. Atkinson
	Total for the year ending December 31, 1907			60,540	40,650	19,890		

14	West Maui	Lahaina, Kaanapali and Wailuku	Maui	§44,482	19,147	25,335	Apr. 21, 1908	W. F. Frear
15	Makawao	Hamakuapoko	Maui	* 1,830	1,830	.....	" " "	"
16	Waiaha Spring	Kona	Hawaii	193	193	.....	" " "	"
	Total for the year ending December 31, 1908			46,505	21,170	25,335		
17	Mauna Kea	Hamakua	Hawaii	66,600	66,600	.....	June 5, 1909	"
18	Waihou Spring	Hamakuapoko	Maui	84	74	10	" " "	"
19	Lihue-Koloa	Puna and Kona	Kauai	¶29,260	13,365	15,895	" " "	"
20	Moloaa	Koolau	Kauai	° 5,621	3,578	2,043	" " "	
	Total for the year ending December 31, 1909			101,565	83,617	17,948		
21	Pupukea	Koolauloa	Oahu	865	865	.....	May 10, 1910	E. A. Mott-Smith
22	Hauola	Hamakua	Hawaii	7	7	.....	June 13, 1910	W. F. Frear
23	Kahoolawe	County of Maui	Kahoolawe	28,260	28,260	.....	Aug. 25, 1910	"
	Total for the year ending December 31, 1910			29,132	29,132	.....		
24	South Kona	Kona and Kau	Hawaii	36,952	29,260	7,692	May 17, 1911	"
25	Puna	Puna	Hawaii	19,850	19,850	.....	June 29, 1911	"
	Total for the year ending December 31, 1911			56,802	49,110	7,692		
26	Molokai	Kona and Kau	Molokai	44,674	13,268	31,406	Sept. 11, 1912	"
27	Kula	Kula	Maui	6,075	5,069	1,006	" " "	"
	Total for the year ending December 31, 1912			50,749	18,337	32,412		
28	Nanakuli	Waianae	Oahu	1,010	1,010	.....	June 4, 1913	"
29	Makua-Keaau	Waianae	Oahu	4,716	4,376	340	" " "	"
30	Kuaokala	Waialua	Oahu	434	434	.....	" " "	"
31	Kohala Mt.	N. and S. Kohala	Hawaii	29,627	14,204	15,423	" " "	"

FOREST RESERVES, TERRITORY OF HAWAII. Arranged in Chronological Order.

No.	Name	District	Island	Total Area Recomme ded to be Reserved.	Area Government Land.	Area Private Land.	Date of Proclamation	Proclamation Signed by
				Acres.	Acres.	Acres..		
32	Upper Waiakea	Puna	Hawaii	51,800	51,800	.....	Oct. 13, 1913	E. A. Mott-Smith
33	Upper Olaa	Puna	Hawaii	9,280	9,280	.....	" " "	"
34	Honolulu Watershed	Honolulu	Oahu	6,950	5,000	1,950	" " "	"
	Total for the year ending December 31, 1913			103,817	86,104	17,713		
35	Kuliouou	Honolulu	Oahu	214	214	.....	Feb. 13, 1914	L. E. Pinkham
36	Kipahulu	Kipahulu and Kaupo	Maui	10,600	4,600	6,000	Aug. 20, 1914	"
37	Olaa For. Park	Puna	Hawaii	531	531	.....	" " "	"
	Total for the year ending December 31, 1904			11,345	5,345	6,000		
	Grand Total, December 31, 1914			798,214	546,222 68 p.c.	251,992 32 p.c.		

‡ Boundary modified and area enlarged from 3,257 to 3,653 acres by proclamation of Gov. Frear, September 11, 1912

§ " " " " " " 44,440 to 44,482 " " " " " " February 4, 1911.

* " " " " " " 1,796 to 1,830 " " " " " " June 5, 1909.

† " " " " " " 65,850 to 66,066 " " " " " " February 4, 1911.

° " " " " reduced " 5,670 to 5,621 " " " Act.-Gov. Mott-Smith, Oct. 13, 1913.

¶ By land exchange 420 acres transferred from private to government ownership.

FOREST RESERVES, TERRITORY OF HAWAII. Arranged by Islands and Counties.

COUNTY OF KAUAI.

5	Halelea	Halelea	Kauai	37,500	10,990	25,510	Aug. 24, 1914	A. L. C. Atkinson
6	Kealia	Puna	Kauai	9,935	7,385	2,550	Mar. 9, 1906	"
13	Na Pali-Kona	Na Pali and Kona	Kauai	60,540	40,650	19,890	June 12, 1907	"
19	Lihue-Koloa	Puna and Kona	Kauai	¶29,260	13,365	15,895	June 5, 1909	W. F. Frear
20	Moloaa	Koolau	Kauai	° 5,621	3,578	2,043	" " "	"
	Total for Kauai			142,856	75,968	66,888		

CITY AND COUNTY OF HONOLULU (OAHU).

1	Kaipapau	Koolauloa	Oahu	913	913	....	Nov. 10, 1904	G. R. Carter
7	Ewa	Ewa, Waianae and Waialua	Oahu	28,550	5,151	23,399	Mar. 9, 1906	A. L. C. Atkinson
10	Waianae-kai	Waianae	Oahu	‡ 3,653	3,546	107	Sept. 7, 1906	G. R. Carter
11	Lualualei	Waianae	Oahu	3,743	3,743	....	Nov. 30, 1906	"
21	Pupukea	Koolauloa	Oahu	865	865	.....	May 10, 1910	W. F. Frear
28	Nanakuli	Waianae	Oahu	1,010	1,010	.....	June 4, 1913	"
29	Makua-Keaau	"	Oahu	4,716	4,376	340	" " "	"
30	Kuaokala	Waialua	Oahu	434	434	.....	" " "	"
34	Hon. Watershed	Honolulu	Oahu	6,950	5,000	1,950	Oct. 13, 1913	E. A. Mott-Smith
35	Kuliouou	Honolulu	Oahu	214	214	.....	Feb. 13, 1914	L. E. Pinkham
	Total for Oahu			51,048	25,252	25,796		

COUNTY OF MAUI.

4	Koolau, Maui	Koolau and Hamakualoa	Maui	42,969	30,230	12,739	Aug. 24, 1905	A. L. C. Atkinson
12	Hana	Hana	Maui	14,825	13,767	1,058	Nov. 30, 1906	G. R. Carter
14	West Maui	Lahaina, Kaanapali and Wailuku	Maui	§44,482	19,147	25,335	Apr. 21, 1908	W. F. Frear
15	Makawao	Hamakuapoko	Maui	* 1,830	1,830	.....	" " "	"
18	Waihou Spring	Hamakuapoko	Maui	84	74	10	June 5, 1909	"
23	Kahoolawe	County of Maui	Kahoolawe	28,260	28,260	.....	Aug. 25, 1910	"
26	Molokai	County of Maui	Molokai	44,674	13,268	31,406	Sept. 11, 1912	"
27	Kula	Kula	Maui	6,075	5,069	1,006	" " "	"
36	Kipahulu	Kipahulu and Kaupo	Maui	10,600	4,600	6,000	Aug. 20, 1914	L. E. Pinkham
	Total for Maui			193,799	116,245	77,554		

FOREST RESERVES, TERRITORY OF HAWAII. Arranged by Islands and Counties.

COUNTY OF HAWAII.

No.	Name	District	Island	Total Area Recommended to be Reserved.	Area Government Land.	Area Private Land.	Date of Proclamation	Proclamation Signed by
				Acres.	Acres.	Acres.		
2	Hamakua Pali	Hamakua	Hawaii	18,940	16,333	2,607	Dec. 23, 1904	G. R. Carter
3	Hilo	Hilo	Hawaii	110,000	60,223	49,777	July 24, 1905	A. L. C. Atkinson
8	Honuaula	Kona	Hawaii	665	665	.....	Apr. 4, 1906	"
9	Kau	Kau	Hawaii	†66.066	59,811	6,255	Aug. 2, 1906	G. R. Carter
16	Waiaha Spring	Kona	Hawaii	193	193	.....	Apr. 21, 1908	W. F. Frear
17	Mauna Kea	Hamakua	Hawaii	66,600	66,600	.....	June 5, 1909	"
22	Hauola	Hamakua	Hawaii	7	7	.....	June 13, 1910	E. A. Mott-Smith
24	South Kona	Kona and Kau	Hawaii	36,952	29,260	7,692	May 17, 1911	W. F. Frear
25	Puna	Puna	Hawaii	19,850	19,850	.....	June 29, 1911	"
31	Kohala Mt.	N. and S. Kohala	Hawaii	29,627	14,204	15,423	June 4, 1913	"
32	Upper Waiakea	Hilo	Hawaii	51,800	51,800	.....	Oct. 13, 1913	E. A. Mott-Smith
33	Upper Olaa	Puna	Hawaii	9,280	9,280	.....	" " "	"
37	Olaa For. Park	Puna	Hawaii	531	531	.....	Aug. 20, 1914	L. E. Pinkham
	Total for Hawaii			410,511	328,757	81,754		
	Grand Total, December 31, 1914			798,214	546,222 (68 p.c.)	251,992 (32 p.c.)		

¶By land exchange 420 acres transferred from private to government ownership.

‡ Boundary modified and area enlarged from 3,257 to 3,653 acres by proclamation of Gov. Frear, September 11, 1912

§ " " " " " " 44,440 to 44,482 " " " " " " February 4, 1911.

* " " " " " " 1,796 to 1,830 " " " " " " June 5, 1909.

† " " " " " " 65,850 to 66,066 " " " " " " February 4, 1911.

° " " " " reduced " 5,670 to 5,621 " " " Act.-Gov. Mott-Smith, Oct. 13, 1913.

FENCING FOREST RESERVE BOUNDARIES.

But technical delimitation on a map and the formal phraseology of a proclamation do not alone constitute true reservation of a forest, nor do they protect it from the inroads of stock and other trespass. They are necessary preliminary steps which have to be taken, but they must be followed up, if the desired results are to be attained, by fences, forest rangers, and suitable administrative control of the reserves.

Getting the forest reserves throughout the Territory technically established has been a principal part of the forest reserve work in the past decade. The job for succeeding years is to make the reserves do their full duty in the best way.

The years 1913 and 1914 have, however, seen a marked advance in the better care of the Hawaiian forests. The action of the Legislature of 1913 in setting apart the water revenues from streams on government lands as a special fund to be used for forest and hydrographic work made a red letter day in the history of forestry in Hawaii. It was one result of the long campaign that has been carried on by the Board of Agriculture and Forestry to secure better protection of the native forests.

Under the terms of the new law (Act 57 of 1913), one-half of the revenues derived from the lease of water rights is devoted to forest work. The annual income from water rights is a little over $66,000. The share of forestry for 1913 and 14 was therefore $33,000 per annum, an increase of about $22,000 per annum over the amount which the Division of Forestry had had in recent years. Continuing the staff of the Division of Forestry unchanged and making the same provision as in the past for its routine work, the bulk of the water money was allotted in July, 1913, for the construction of forest fences on the boundaries of certain forest reserves across government land or on party lines where the government was one owner, in places where there were no natural barriers, or where there yet remained gaps in existing lines of fence.

During the 20 months covered by this report fencing projects have been undertaken and in most cases have already been completed, in the following districts:

Name of Project.	District	Island
Moloaa	Hanalei	Kauai
Wailua	Lihue	Kauai
Lualualei (two)	Waianae	Oahu
Waihou Spring	Makawao	Maui
Nahiku	Hana	Maui
Kawaihae	N. Kohala	Hawaii
Waiaha Spring	N. Kona	Hawaii
Ninole	Kau	Hawaii

Other fencing projects were contemplated, and had been provisionally arranged for, when in the spring months of 1914 came the call from the Territorial Administration to retrench in every possible manner. This has led to the postponement of several important fencing projects and the elimination of several more that were regarded as highly desirable. The projects already under way will all be completed by the end of this calendar year.

FENCING UNDER LEASE REQUIREMENTS.

In addition to the fences built with the water revenues, considerable other forest fencing was done during 1913-14 by ranch and plantation companies under the requirements of government leases covering agriculture or grazing land adjoining forest reserves. In particular attention may be called to fences built in this way in the Districts of Hanalei on Kauai, Kula and Wailuku on Maui (two in each case), and North Kohala on Hawaii.

Two of the fencing projects on Maui coming under this head are of particular interest. The fence on the boundary of the Kula Forest Reserve, from Waiakoa to Keokea, built by the Cornwell Ranch, and the repair and rebuilding of the fence around the Polipoli Spring section of the same reserve, by Dr. J. H. Raymond. With the completion of a short stretch of stone wall on the Kahikinui slope, now being built by Dr. Raymond, and the contemplated removal from Haleakala of a band of semi-wild cattle, now at large at the south end of the mountain, these fences, provided they are properly looked after, will satisfactorily protect the area included in the Kula Forest reserve. In that one of the chief reasons for setting apart this area was to provide for its ultimate afforestation with temperate zone trees, this step is an important one. Practically all of the Government land included in the Kula Forest Reserve is too poor in character to be of value for grazing, but it can be made to grow such trees as pines, firs and cedars. It is the intention of the Board of Agriculture and Forestry to start such planting as soon as there are any funds available for the purpose. Consequently the completion of these fences now is particularly timely. Mention should be made of the fact that the Cornwell Ranch carried the forest reserve fence across its fee simple land of Kaonoula, thus throwing the mauka portion of that land into the reserve.

On Kohala Mountain, Hawaii, under the requirements of leases obtained from the Government in July, 1913, the Parker Ranch has repaired and put in shape the forest fences on the entire south face of that mountain on the boundary of the forest reserve. In this case, too, several blocks of fee simple land have been fenced off and included in the reserve.

An inspection of other forest fences on Hawaii, in the Hamakua and Hilo Districts, was made by me during the early autumn of 1913. It showed the forest reserve fences around Mauna Kea and, with one exception, those on the mauka side of the Hilo Forest Reserve, to be in good condition. On the mountain the fences are maintained under lease requirements by the Parker Ranch, the Kukaiau Ranch and the Humuula Sheep Station. Across the several private lands in the Hilo District, from Honohina to and across the government tract of Piihonua, Mr. W. H. Shipman was then just completing the relocation and rebuilding of the Puu Oo Ranch forest fence, approximately on the mauka boundary of the Hilo Forest Reserve. This fence is a substantial one, put up in a thoroughly satisfactory way.

On the boundary between Humuula and the Hilo forest the fencing is of recent date, and in good condition. On the government land of Piha there has been trespass and a generally unsatisfactory state of things, but arrangements are now well advanced that will soon put an end to that condition. Steps are also now being taken by the Government to prevent trespass by cattle along the lower edge of the Hilo Forest Reserve, above Hakalau, a matter which has been under consideration by the Division of Forestry for some time.

On the Kona side of Hawaii the Trustees of the Bishop Estate have within the past year had several miles of forest fence built and repaired on the boundaries of their private forest reserve above Kealakekua.

In Kau the forest fence along the mauka side and at the East and West ends of the Kau Forest Reserve have recently been, or are at this date, in process of being reconstructed. The upkeep of these fences is required under government leases held respectively by the Hawaiian Agricultural Company and the Hutchinson Sugar Plantation Company. By mutual agreement between these companies and the Kahuku Ranch, portions of the mauka line are to be fenced by the latter. This work is now in progress. The sections built by the two plantations have already been completed. Both were inspected by me during a special trip made to Kau for that purpose in July, 1914.

The Hutchinson Plantation fence consists of four strands of No. 4 German galvanized wire, with substantial posts set 10 feet apart. It runs from the northwest corner of the reserve eastward along the mauka boundary of the forest for approximately 7 1-2 miles. It is a thoroughly good piece of fence work and should give good service.

The Hawaiian Agricultural Company's fence follows the line of the forest fence first erected by that company in 1896. The old fence was entirely rebuilt both as to posts and wire in 1913. It now consists of five strands of No. 7 wire, English make, with posts of Ohia or Split Koa set 8 feet apart. This fence encloses the entire east end of the Reserve. The length is approximately 15 miles. It was built under the personal supervision of Mr. Julian Monsarrat, who for 18 years now has had charge of the mountain fences of the Hawaiian Agricultural Company. Properly maintained, as the past record of the company gives assurance that it will be, this fence will be an efficient barrier for many years. Special mention is made of these fences here because the proper fencing of the Kau Forest Reserve is a matter that has received not a little attention from the Board. Because of them, and the other fences enclosing it, the Kau Forest Reserve is now among the best protected of any of the forest reserves in the Islands.

FOREST EXTENSION.

The encouragement of tree planting has always been a very important part of the work of the Division of Forestry. It is carried on by the division in three ways: First, by the actual planting of government land with stands of forest trees: second, by the maintaining of nurseries for the propagation and distribution of tree seedlings; and third, by the giving of advice on the best methods of growing and caring for trees planted for profit, for shade or for pleasure.

During the past two years, under the water revenues fund, the Division of Forestry has itself carried on several planting projects. Perhaps the most important of these is the reforestation of a portion of the Honolulu Watershed on Oahu. Here, on the slopes of Sugar Loaf, at the head of one of the branches of Makiki Valley, a stand of Hawaiian Koa (*Acacia Koa*) has been set out, extended lower down on the sides of the gulch by another native tree, Kukui (*Aleurites moluccana*). As a part of the city water supply for Honolulu comes from springs in the branches of Makiki Valley the planting of these slopes has economic significance. Incidentally the reclothing of the grass-covered hills above the city will add much to the attractiveness of the view toward the mountains.

Beginning in July, 1913, with the preparations for planting, some 23 acres have now feen set out. The Koa trees are spaced 15 x 15 feet, with the intention of securing a complete cover on the slopes. It is expected that this planting will be continued over all the open ridges between Sugar Loaf and the Tantalus forest.

Another planting project carried forward by the Division of Forestry has been the continuation of the tree planting undertaken by the Alexander & Baldwin interests on Government land along the Koolau Ditch system on windward Maui. Begun in 1911 under a planting plan drawn up by the Division of Forestry, the purpose of this planting is to assist in restoring the dense cover of vegetation on portions of this important watershed which had been opened up through the dying off of the forest during the years 1906 to 1908. The work of the past year has been primarily in caring for the seedlings previously planted until they became established, and in extending somewhat the areas set in trees. In part this planting is experimental. Various species of Eucalyptus are being tried out, while attention has also been paid to increasing the spread of Koa and of the native Bamboo.

Further, in the way of experimental tree planting, the Division of Forestry has made progress during the past two years. Under its auspices such planting is now in progress in five localities: two on Maui, two on Oahu and one on Kauai. Those on Maui are at Kailiili, above Makawao, and on the Government remnant called Polipoli, above Wailuku in the West Maui Forest Reserve. At Kailiili, through an arrangement with the Maui Agricultural Co., a number of species of Eucalypts are being planted in definite plots on a section of open land in the Makawao Forest Reserve, in return for the privilege granted that Company of removing dead wood from the land.

Among the trees being tried at Kailiili are the following species of Eucalypts: *E. gomphocephala ,E. goniocalyx, E. hemiphloia, E. longifolia, E. leucoxylon, E. macrorhyncha, E. maculata, E. marginata, E. paniculata, E. polyanthemos, E. punctata, E. saligna, E. siderophloia, E. sideroxylon,* and *E. tereticornis.*

Other trees in the plantation are: *Pinus massoniana, P. canariensis, P. radiata, and P. tuberculata.*

On the windward of the block is a belt of *Eucalyptus robusta.*

Each species is in a plot by itself, plainly marked by a stake with a metal tag bearing the tree name and the date of planting. The object is to try out valuable species at present imperfectly known in Hawaii. Those that are found to do well at Kailiili can later be recommended for other localities where the conditions are similar as to elevation, rainfall and wind exposure.

This project has been carried on for the Division of Forestry by Mr. W. Hannestad, forester for the Maui Agricultural Co., in connection with the extensive tree planting that he has been doing on the privately owned lands of that company lying just to windward of the Government tract. This private forest at Kailiili constitutes the largest area of artificially established forest in the Territory. Eucalypts of several different species have been the trees used, and since in almost all the stands the trees are close spaced, the result is true forest planting. The Kailiili forest should be of great value in years to come to the Maui Agricultural Company, not only for fuel but as well and more particularly for posts, railroad ties and other timber.

The experimental planting above Wailuku has been carried on for the Division of Forestry by the Wailuku Sugar Company in connection with other planting which that company has been doing on the foothills back of the plantation. Plots of the following species of Eucalypts have been planted: *E. corynocalyx, E. diversicolor, E. saligna,* and *E. tereticornis.*

The purpose here is the same as at Kailiili, to try out trees new to Hawaii, under a variety of conditions. The project has had the personal supervision of Mr. H. B. Penhallow, manager of the Wailuku Sugar Co., who has taken the greatest interest in getting trees started on all the waste, upper lands of the plantation from Waihee to Maalaea Bay.

On Oahu the experimental plantation of Eucalypts in Nuuanu Valley, started in 1911 with funds supplied by the U. S. Forest Service, may now be regarded as established. During the past two years all the blanks in the original planting have been filled and the little trees kept free from grass until they grew large enough to take care of themselves. There have been no serious set backs in this plantation through the trees dying or from other reasons. From it valuable data should be secured in later years as the trees develop.

The other locality on Oahu where experimental tree planting has been done is Makiki Valley, where in the vicinity of and in connection with the experimental garden maintained by the Division of Forestry, many species of trees new to Hawaii have been started and planted out.

On Kauai, above the sub-nursery maintained by the Division of Forestry at Homestead, in the Papapaholahola Spring Reserve, blocks of a number of forest trees have been planted and are thriving. Especially to be noted here are the stands of Sugi or Japanese Cedar (*Cryptomeria Japonica*), a tree that when planted in the right localities is bound to be of great value in the Islands. The local nursery at Homestead, as well as the experimental planting, is being looked out for by Mr. Walter D.

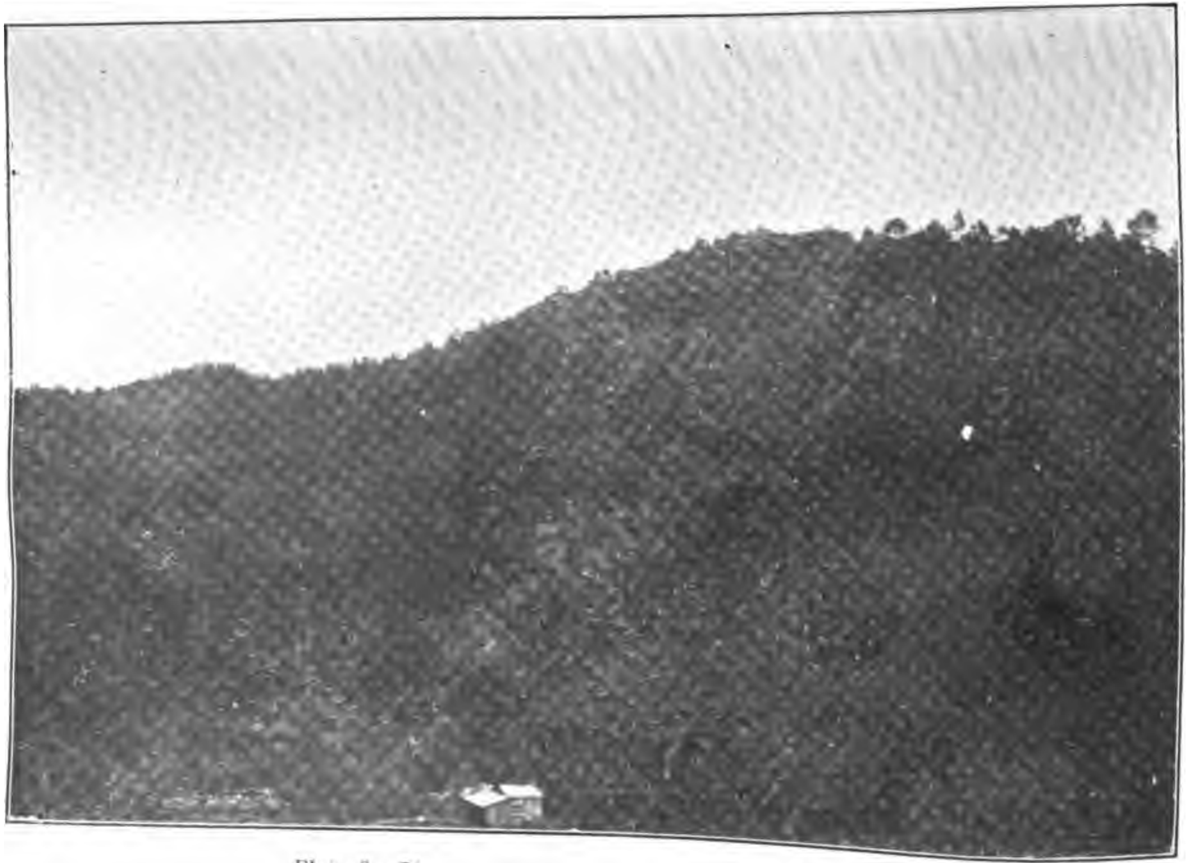


Plate 3. Planted Forest on Tantalus near Honolulu

McBryde, who for many years has been a most enthusiastic tree planter.

Federal Assistance in Tree Planting.

With the close of the fiscal year, June 30, 1914, came the discontinuation of the allotments that had been made for six years by the U. S. Forest Service for experimental tree planting in Hawaii. Having before gradually diminished the amount, the service was obliged this year entirely to discontinue this project because of pressing demands in other directions requiring all its appropriations, particularly for combatting forest fires. But the attitude of the Forest Service in regard to this project is shown by the following paragraph from a letter from Mr. Henry S. Graves, Chief Forester of the United States, under the date of May 7, 1913:

"Your report on the experimental planting indicates conclusively that you have obtained good results from this intensive study of the possibilities of reforestation in portions of the Hawaiian Islands. I feel that there is no question as to the wisdom of your undertaking these experiments or of the Forest Service's participating in them on the small scale which has been possible for us. I wish very much that it might be possible for us to continue this cooperation on the same small scale as during the present fiscal year."

The amount allotted for 1912-13 was $500; for 1913-14, $188. The greater part of this money was expended for labor in the Experimental Plantation of Eucalyptus in Nuuanu Valley, Oahu, already referred to, in caring for the small trees until they became established.

The earlier work with the Federal funds was on the high mountains on Hawaii and Maui, in the trial of temperate zone trees, especially conifers. Arrangements are now pending whereby such work can be resumed under Territorial auspices on the upper slopes of Mt. Haleakala. But in view of the fact that the first chapter of this investigation is now closed, it may not be out of place to insert here a summary of the results obtained with Federal funds which I drew up for the Forest Service in February, 1914, as follows:

"Returns from the planting on the high mountains have not been as great as it was hoped would be the case. Through unavoidable changes of program due to the death in one case and the unexpected departure in another of employees of neighboring ranches who were cooperating in the work, the original planting was handicapped, both through loss of material and through inability to secure proper care in the raising of seedlings in local nurseries. Further, climatic conditions at the higher plots on both mountains were found to be more unfavorable than had been anticipated. But of the original seedlings and transplants set out, enough individuals have become established to show that such work is feasible. So, too, with the seed spots. Enough seedlings have come up and lived through to give information that is decidedly worth while as to species to be granted further trial and as to methods to be used in subsequent work. Also, of course, the fenced enclosures on both Mauna Kea and Haleakala remain to be used in later experiments."

"Strictly considered, the experimental plantings on the high mountains in Hawaii, whether of seedlings or of seed, so far carried on, would probably have to be classed as failures, but summing up the situation, I believe this project of the Forest Service to have been justified, first: because it has started a greatly needed study that is much more likely to be carried forward by the Territory now that there has been provided fenced enclosures that can continue to be used for a long time. Second: because while the results in actual numbers of growing plants are meagre, it has been shown what classes and types of trees are needed: namely, conifers accustomed to semi-arid conditions, as some of those from the American Southwest and Northern Mexico, or other related species. And, third, because considerable light has been thrown on methods desirable to follow or to avoid. To have got this information is worth while."

One of the essential needs in forestry in Hawaii has been and is, that trees new to the islands be systematically tried out under the varying local conditions. With the pressing necessity to use Territorial revenues in other ways, it was possible to undertake such experimental planting only with the aid of Federal funds. A good share of the money expended has gone into supplying equipment that can be used for a long time to come. By inaugurating this investigation the Forest Service has rendered a lasting benefit to the Territory of Hawaii."

Plant Distribution.

Following the usage of past seasons the Division of Forestry has continued to grow and distribute free or at cost price, seedling trees to all those desiring them in any part of the Territory.

It is the intention of the Division to keep constantly on hand a few thousand each of the species most often called for—forest, shade and ornamental trees—to meet current demands. When larger numbers are desired though for forest planting by sugar plantation companies or other corporations, special consignments are started on due notice and shipped when the seedlings are large enough to plant out. Many corporations are finding it easier and cheaper to secure from the Government Nursery seedlings in seed boxes, just ready for transplanting, rather than to grow them themselves. This is partly because most of the troubles in growing trees, such as the damping off fungus, etc., occur in the very early stages of a tree's life.

Large lots can be got ready for shipment in from six weeks to two months, depending on the species. It is then a simple matter to transplant the seedlings and look out for them locally for a month or two more, when they are of sufficient size to be planted in their permanent place. The cost of the common forest tree seedlings in seed boxes varies from a dollar to a dollar and a half for 800 to 1000 plants. Pot-grown seedlings of shade and ornamental trees usually sell for 2½ cents each, the intention being in each case to have the price just cover the cost. Further details in regard to this phase of the work of the Division of Forestry may be found in the report of the Forest Nurseryman, to whom should be addressed, at Box 207, Honolulu, all inquiries about the purchase, setting out and subsequent care of forest, shade and ornamental trees.

Beside the Government Nursery at Honolulu, the Division of Forestry also maintains sub-nurseries at Hilo, Hawaii (in charge of Brother Matthias Newell), and at Homestead, Kauai (under the care of Mr. Walter D. McBryde).

The report of the Forest Nurseryman covers this subject more in detail. It should be consulted by those interested.

The Government Nursery, as a rule, does not deal in ornamental shrubs, nor in fruit trees. But during the past several years an exception has been made as regards the former class of plants in favor of the United States Army. With the influx of soldiers into Hawaii, and the establishment and expansion of the various posts and forts on Oahu, the Division of Forestry has deemed it justifiable to cooperate as far as it reasonably could in helping to make their new quarters habitable, both for officers and enlisted men. The result has been that the Quartermaster's wagons have been frequent visitors at the Nursery, especially during the last two years, and that many plants have been furnished both to carry out the official programs of post planting and to make more attractive the temporary quarters that precede the permanent streets and houses at the forts. During 1913 there was distributed in this way to the army a total of 4,447 plants from the Government Nursery. One of the most satisfactory things about this army distribution is that almost every plant sent out is taken care of until established—a fate that unfortunately does not always befall the little trees that go from the Nursery on other orders.

Arbor Day continues to be a convenient point of departure for efforts to get more people interested in tree planting. Coming the second Friday in November, trees set out then get, in normal season the advantage of the winter rains. Arbor Day is essentially the time for the free distribution of trees, but for the past two years a strong effort has been made to direct the distribution more carefully than in years before, so that trees should only be sent to those who really wanted them. The total number distributed is thus reduced, but it is believed that the net results are considerably higher.

Especial efforts have been made, both in 1913 and during this year, to get trees into the hands of the homesteaders at Haiku, Maui, Kapaa, Kauai and Waimea (Kamuela), Hawaii, all newly opened tracts where the settlers are trying to develop real American communities.

Advice on Forest Matters.

Along with the actual distribution of plant material the Division of Forestry performs the important function of being ready at all times to offer technical advice about every sort of forest work from sowing the seed to securing a second crop of trees after a stand of timber has been harvested.

The preparation of detailed planting and working plans is not often called for, though a few are drawn up each year, but much advice is given verbally and by letter every month. Indeed, judged by the number of requests that come in, this branch of the work is one of the most useful activities of the Division of Forestry. No charge is made for the suggestions given, whether at the Nursery or on the ground, except that in the latter case, if the locality visited is out of Honolulu, the actual traveling expenses of the agent sent are borne by the applicant. This function of the Division of Forestry is already pretty generally known, but it does no harm to say again that the members of the staff are always ready to answer any inquiries that may be made as to the how and why of forest work.

Plant Introduction.

One other phase of work of the Division of Forestry is entitled at least to mention in this report—the introduction into Hawaii of trees and shrubs new to the Territory. In earlier paragraphs the work in experimental planting has been described. This section deals with the bringing in of new plants. Lack of funds that could be devoted to it and the inherent difficulties of trying out new introductions without a series of experiment gardens under the control of the Division of Forestry, at various elevations and under differing climatic conditions, have kept this work down to very simple terms. But it remains a line of investigation that Hawaii ought to take hold of and push vigorously. Properly carried on there are few places in the world where the results from the introduction of valuable plants would be of more immediate value to the community.

During the past year and a half a number of new plants have been received by the Division of Forestry, through gift and exchange, which are now being propagated for subsequent distribution. Especially may be noted a consignment of American basket willows, sent by the U. S. Forest Service as the result of our investigations two years ago with a basket willow from the Azores; a Juniper from the West Indies, brought back by Mr. Gerrit P. Wilder, and a variety of plants, largely ornamental, grown from seed collected and sent in by Mr. Joseph F. Rock, Consulting Botanist of the Board, while on an official tour around the world in the interest of the Botanical Department of the College of Hawaii. It is decidedly to be hoped that in later years this branch of the Division of Forestry may receive more attention than it has been thought practicable to give it in the past.

Tree Planting Under Private Auspices.

Owing to the general retrenchment that has been necessitated throughout the Territory by the approaching removal of the tariff on sugar, there has unavoidably been a marked falling off in tree planting, especially by sugar plantation companies. But nevertheless enough planting has been done to make it certain that there has been no decrease in interest in the matter. The fact that fewer trees have been set out is purely a question of lack of funds.

No data have as yet been compiled for 1913 and 1914 as to the number of trees planted by corporations, but from notes in hand I believe the total for 1913 will be found to be about one million trees. Of the sugar plantation companies that are actively —though, of course, in varying degrees—keeping up their tree planting, mention may be made of Makaweli, Grove Farm, Lihue and Kealia on Kauai; of Waialua on Oahu; of Wailuku and the Maui Agricultural Company on Maui; and of Honokaa, Paauilo and Pahala on Hawaii.

Several ranch companies are also actively continuing their tree planting, particularly the Parker Ranch on Hawaii and the Haleakala Ranch on Maui. And under the requirements of Government Land Office leases, extensive blocks of trees are being planted by the Kukaiau Ranch on Hawaii and the Cornwell Ranch on Maui. Inspections of both these projects made during the early summer of 1914 showed the work to be going on in earnest and the trees already planted to be in good condition.

The forest plantation started by the Division of Forestry in 1910 and 1911 at Pupukea, Oahu, and above Waimea, Hawaii, are both in excellent condition—the trees growing well and developing fast.

In March, 1914, another cooperative tree planting agreement, similar to the one made with Mr. C. G. Owen, of Pupukea, in 1912, was entered into with Messrs. Macfarlane and Robinson of Paumalu, Oahu, for the planting of a part of "Water Reserve A," a section of the Pupukea Forest Reserve. Temporarily the land is to be used for growing pineapples. During the year 1917 it will be planted with trees. The area involved is 3¼ acres. The faithful performance of the contract is insured by a bond made out in favor of the Territory.

MISCELLANEOUS ACTIVITIES.

Algaroba Licenses.

In addition to its regular lines of work the Division of Forestry is frequently called on to cooperate with other branches of the Territorial Government in matters more or less directly connected with forestry. By arrangement with the Commissioner of Public Lands all matters relating to public forests, whether within the limits of forest reserves or not, are referred to the Board of Agriculture and Forestry for its special recommendations. Thus during the past year the Division of Forestry has drawn up plans for, and subsequently made inspections in the field of, the thinning of certain Algaroba groves which the Government desired to bring to a condition that would lead to the greatest possible production of flowers and beans, valuable locally for bee pasture and stock feed. The localities for which these algaroba licenses were issued were Nanakuli and Waianae, Oahu and Kihei, Maui.

Hawaii Hardwood Lumber Company.

In October, 1913, an inspection was made of the operations of the Hawaii Hardwood Company, successors to the Pahoa Lumber Mill of the Hawaiian Development Co., in Puna, Hawaii. This concern is logging Ohia lehua on government and private land in that district, but so far has barely reached the section set apart as the Puna Forest Reserve, although an advance payment was made in 1911 for the timber on 591 acres of it. Since the organization of the present company, following the loss of the Pahoa lumber mill by fire in January, 1913, the operations both in the woods and at the mill have been much more systematic and thorough than at any time in the past. Practically everything except small branches is taken out of the forest, to be worked up at the mill or sold as fuel. And at the mill scarcely any waste goes into the trash fire.

Through persistent activity a place has been made in mainland markets for Ohia, and the mill is kept busy in supplying the increasing demands for Ohia, in one or another form. The

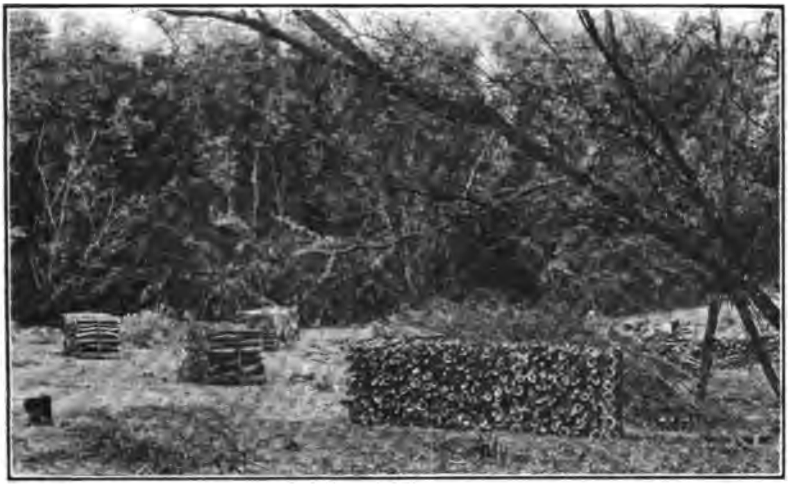


Plate 4. Fig. 1 Cutting Algaroba in the Purely Commercial Forest on the Dry Lowlands

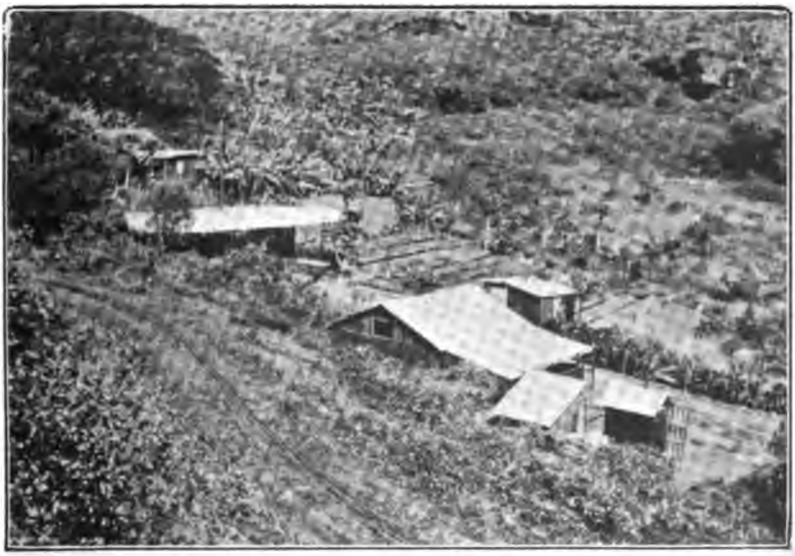


Plate 4. Fig. 2. Makiki Nursery, Honolulu.

use to which Ohia seems best adapted is flooring and wainscoting. Comparatively little Ohia is now sold for railroad ties, notwithstanding it was on this basis that the original company was organized. With its operations conducted as at present, in the forest and at the mill, the Territory can have no complaint against the Hawaii Hardwood Company on the score of non-utilization.

As more of the area of Ohia forest so far cut over has proved to be agricultural land, it is probable that the portion owned by the Government will sooner or later be opened for homesteading. Whether that lying within the boundary of Puna Forest Reserve is of like character remains yet to be seen.

Fence Post Test.

In August, 1914, a cooperative arrangement was entered into by the Division of Forestry and the College of Hawaii whereby there will be tried out for fence posts on the College Farm in Manoa Valley, Honolulu, timbers from a number of locally grown species of Eucalypts. The posts were cut from trees felled in the Tantalus forest under the direction and at the cost of the Division of Forestry. The hauling and setting of the posts and the treating of them with preservatives was paid for by the College. The following species were used, the posts being cut from the trees averaging about thirty years in age: *E. calophylla, E. citriodora, E. cornuta, E. globulus* and *E. robusta.* The results of this test will be made public from time to time in the Hawaiian Forester and Agriculturist.

Permits in Forest Reserves.

During the year 1914 a somewhat new departure has been made by the Division of Forestry in the issuance of a number of permits for privileges within certain of the forest reserves for which a cash return was demanded. Therefore most of the permits given have been for free use. Thus on Oahu, in the Honolulu Watershed Forest Reserve, three permits were given authorizing the holders to live on the reserve for a limited period, and make use of small portions of it for gardens. In return the permittees, in addition to the fee paid to the Government, agree to turn out in case of need, to fight forest or brush fires. One grass cutting permit was also issued for the Tantalus Ridge section, and one giving the holder the privilege of hunting wild cattle and pigs in the Upper Olaa Forest Reserve on Hawaii. All these permits are for limited periods only, and are made only on the condition o' the compliance with strict requirements.

In August, 1914, one more permit was issued granting the privilege of establishing a mountain outing camp on the upper slopes of Haleakala, Maui, in the Kula Forest Reserve, in return for assistance to the Government in experimental tree planting in that reserve. In each case the object of these permits is to allow the fullest use to be made of the land, consistent with its proper maintenance as a forest reserve.

Honorary Forest Rangers.

Another departure in 1914 was the appointment of several Volunteer (or Honorary) Forest Rangers, to assist the Board in giving better protection to certain of the Forest Reserves. To this position for the Honolulu Watershed Forest Reserve, Oahu, were appointed Messrs. Charles L. Beal and E. H. Hipple, of Honolulu; for the districts of Hilo and Puna, Hawaii, Mr. W. H. Shipman, of Hilo. The appointment of Mr. Beal was made primarily on account of the interest he has shown in repairing and extending the trails on the mountains back of Honolulu. It was felt that it would mutually be a good thing if the Board had Mr. Beal's assistance and cooperation.

Surrender of Forest Land.

In June, 1914, under the terms of Chapter 28 of the Revised Laws of Hawaii, the Honorable George R. Carter formally turned over to the Board for a period of five years the custody and control of a tract of 132 acres of forest land owned by him at the head of Manoa Valley, Oahu, within the Honolulu Watershed Forest Reserve. This is the second time in the history of the Division of Forestry that such a transfer has been made, the other instance being certain lands on the windward side of Maui that were similarly surrendered by the Alexander & Baldwin interests for a period of years, in 1906. Mr. Carter's action is more important in that it confirms a precedent, than in the actual transfer itself. With a better system of protecting and administering its forest reserves the Territory would doubtless be in receipt of many applications from private owners of forest land requesting that the management of their lands be taken over by the Board.

Publications.

With the exception of the Biennial Report of the Division for 1911 and 1912, issued in March, 1913, the only publication of the Division of Forestry in its regular series has been Botanical Bulletin No. 2: "List of Hawaiian Names of Plants," by Joseph F. Rock, Consulting Botanist of the Board. This pamphlet was issued in June, 1913, and gives the Hawaiian and scientific name for all the indigenous and many introduced trees and shrubs. The data there collected are taken from Mr. Rock's comprehensive contribution to Hawaiian botany entitled "The Indigenous Trees of the Hawaiian Islands," a volume of 518 pages, fully illustrated by 215 full page plates, that was published under patronage and privately printed in Honolulu, in June, 1913. Most of the field work on which this book is based was done when Mr. Rock was a regular member of the staff of this Board.

It was the intention of the Board to publish as a Bulletin, but in somewhat more amplified form, the general description of the Botanical Regions of Hawaii that constitutes the introduction to Mr. Rock's book. But lack of funds, due to the financial retrenchment of the spring of 1914, made it necessary to postpone the issuance of this publication.

As usual routine reports of the Division of Forestry in manuscript have been made to the Commissioners every month, together with many reports on Forest Reserves and other forest matters. The greater part of these reports have later appeared in the Board's monthly magazine, "The Hawaiian Forester and Agriculturist."

During the past two years a series of special, and in a measure confidential, reports on forest conditions on each island have been prepared for the information of the Commissioners. The preparation of all these reports has taken not a little time, but in making them the policy of the Board has been complied with.

In July of each year, statements for the Governor to use in making up his annual report have also been drawn up, and in January, 1914, a brief report of the Division of Forestry for 1913 was prepared, which was published with the reports of the other divisions of the Board in the "Hawaiian Forester and Agriculturist" for May, 1914.

FOREST FIRES.

The forest fire record for this Territory continues to be gratifyingly short. None of the fires reported in 1913 did serious damage although several required not a little hard work to put out before they should reach alarming proportions. The localities and dates of the fires in 1913 and from January to August inclusive, 1914, are as follows:

1913
Feb. 3—Waipio, Oahu.
Mar. 9—Kalihi Valley, Honolulu, Oahu.
" 13—Pacific Heights, Honolulu, Oahu.
" 30—Honouliuli, above Kunia, Oahu.
Apr. 20—Ninole, Kau, Hawaii.
May 20—Kapaa Homesteads, Kauai.
July 23—Pukoo, Molokai.
Aug. 8—Waipouli, Kauai.
" Wahiawa, Oahu (two).

1914

Jan. 26—Nuuanu Valley, Honolulu.

Apr. 10—Palolo Valley, Honolulu.

The majority of these fires were in grass or brush. None of them burned over large areas. But had they not been stopped promptly it is possible that serious damage would have resulted, for several were in localities where, had the fire really got away into the forest it would have been exceedingly hard to combat. The fires near Honolulu were fought by the Honolulu Fire Department and the staff and laborers of the Division of Forestry. Those in the country districts under the direction of the local District Fire Wardens.

For setting the fire above Pukoo, Molokai, two men were arrested. They pleaded guilty, and were fined $25 each.

A number of new names have been added during 1913 and 1914 to the list of Forest Fire Wardens, which list, revised to date, accompanies this report. As in former years the Chief Fire Warden is glad of this opportunity to express the appreciation of the Board on the interest and public spirit shown by the gentlemen named therein in making the Hawaiian Forest Fire Service an efficient skeleton organization, always ready for action.

SUMMARY OF FOREST WORK IN HAWAII,

1904—1914.

In that my resignation as Superintendent of Forestry, and the appointment of my successor will necessarily open a new chapter in the history of the Division of Forestry, it is perhaps not inappropriate briefly to summarize what I conceive to be the essential accomplishments in forest work in Hawaii during the past decade.

The Division of Forestry was established under the Board of Agriculture and Forestry by Act 44 of the Legislature of 1903 (Chapter 28, Revised Laws of Hawaii). During the summer of 1903, at the request of the Board, Mr. Wm. L. Hall, of the U. S. Forest Service, was sent to the Islands to investigate the local situation, and to suggest a forest policy. This he did and in December, 1903, upon recommendation of the Chief Forester of the United States, Mr. Gifford Pinchot, I was appointed Superintendent of Forestry, reporting for duty in Honolulu in January, 1904.

During the past ten years the Division of Forestry has stood consistently for two main objects—(1) the protection and proper administration of the native Hawaiian forest on the important watersheds, and (2) the planting of economically valuable trees on non-agricultural and other waste land.

The more important achievements of the Division may be summed up as follows:

The creation of a forest reserve system and the laying of the foundation for a proper administration of the forest reserves.

A decrease of trespass on the forests by the extension of forest boundary fences, the eradication of wild cattle and goats in most of the reserves, and the awakening of public opinion as to the importance of these measures.

The securing of general assent to the doctrine of tree planting on waste land as evidenced by the establishment of many groves of trees and forest plantations throughout the Territory.

An increase in popular knowledge and appreciation of certain valuable trees, and the keeping up of the agitation of the subject of the importance of systematic investigations with new trees and shrubs.

The carrying on of a campaign of education as to the value and necessity of practicing forestry in these islands, and further as to the intimate relation which the right use of the natural resources—popularly known as "Conservation"—bears to the continued economic well-being of this Territory.

The enactment of a forest fire law and the organization of a forest fire service.

And some share in the strengthening of the general public sentiment in favor of forestry and forest work that has found expression in continued and increased support by the Legislature.

The protection of the areas of native Hawaiian forest covering the important watersheds throughout the Territory has been sought through the creation of forest reserves. The essential object is to equalize and maintain the flow in these streams that feed the various ditch systems which make the water available for irrigation, power development, cane fluming and domestic supply. There are now 37 forest reserves in Hawaii. These reserves include both government and privately owned land. The total area is 798,214 acres, of which 546,222 acres (68 per cent) belongs to the Territory. Twenty-eight of the reserves are essentially protection forests, primarily of value for safeguarding the cover of vegetation on watersheds. The other nine, almost all government land, were set apart that the areas included within their limits might eventually be brought under forest, or that the commercially valuable timber on them might be administered under the Board of Agriculture and Forestry.

Technically the Hawaiian forest reserve system has now been pretty nearly completed. Only a few comparatively small lands remain to be set apart to round out the forest area needed for the protection of the important streams. What has so far been accomplished is essential as the first steps in the program, but to secure the full benefits to be derived from the protection of the forest it must be followed up by systematic administration of the reserves, such as can only be secured by a forest ranger service. The immediate forest problem in Hawaii and the next step in the progress of forestry in this Territory is to get an effective field organization established and in working order.

In large measure the boundaries of the forest reserves either consist of natural barriers or are fenced. Some of the fences are maintained under the requirements of government leases, some have been built and are maintained at government expense, and some are kept up voluntarily by corporations or private owners. The more important corners of a number of the forest reserves have been marked with metal monuments. All the forest reserve boundaries ought to be so defined.

During the past two years the government has constructed a number of new fences. Several other stretches of fence required under leases have also recently been completed, and some other lines of forest fence have been erected at private cost. The general attitude of the public in regard to the protection of the forest has undergone a marked change in the past decade. While there is still more or less trespass going on on each island, the best sentiment is now strongly against it, rather than being hostile or indifferent, as was the case previously.

In a few of the reserves the forest is still being damaged by wild cattle and by goats, but in the last few years a very marked improvement has been effected on each of the larger islands in controlling this form of injury.

The second main line of endeavor pursued by the Division of Forestry since 1904 has been the encouragement of tree planting. This the Department has sought to do by supplying technical advice to all who desired it as to methods and means of nursery and tree planting work, by furnishing free or at cost price tree seedlings of various species, and by a general campaign of education as to the desirability of establishing blocks of planted forest from the standpoints of commercial return, watershed protection or aesthetic consideration.

Tree planting has been practiced in Hawaii both by the government and by private individuals and corporations, for 30 years or more, but in the past few years there has been a marked increase in the number of trees set out and a much better understanding of the necessity for such work than at any time before. The doctrine of using for tree planting non-agricultural land on the sugar plantations that otherwise would be closed as waste area has been persistently preached, until it is now generally acknowledged to be a sound policy to follow wherever it is possible to secure funds to defray the initial cost.

In this campaign much has been written and printed, in regular reports, in the "Hawaiian Forester and Agriculturist," and elsewhere, both as argument and exhortation, and also in the way of concrete examples showing the profit to be derived from tree planting in terms of compound interest. Among this matter the bulletin entitled "Eucalyptus Culture in Hawaii," by Mr. L. Margolin, calls for special mention. This report gives the result of a cooperative study made by the Division of Forestry and the U. S. Forest Service in 1910. That the efforts put forth have really told is evidenced by the increase in the number of trees planted each year. In 1912, the last year for which full records are at hand, the number planted was well over a million and a quarter trees. For the credit of creating this sustained interest the division of Forestry has the right to claim a share.

In this connection it is only fair to make mention of the part played by the Forest Nurseryman of the Division of Forestry, Mr. David Haughs, who has charge of the section of the Division's work in dealing with the growing and distribution of trees. From his long experience in the islands Mr. Haughs' suggestions on all matters relating to tree growing are distinctly worth having. That this part is appreciated is proved by the steady stream of application for advice that come to the Division. Giving assistance of this sort is one of the important functions of this office. It is an essential part of the Territory's forest work.

The introduction and experimental planting of trees new to the islands is a branch of forest work which it has been the aim of the Division of Forestry to foster, ever since its organization. Only by the actual trial of new trees and shrubs can it be known surely whether or not they will succeed here under our local conditions. The Division of Forestry has helped to make better and more widely known several species that had previously been introduced, especially Japanese Cedar, certain of the Eucalypts, and a basket willow from the Azores. It has as well developed the use of Ironwoods as a windbreak for canefields near the ocean, and has started upon the investigation of many new trees about which it is yet too soon to have positive information to give out.

The forest fire law in Hawaii dates from 1905. Under its terms a forest fire service consisting of volunteer district fire wardens has been organized and kept strictly up to date. This skeleton organization has been effective in combatting all fires that have occurred, and furthermore has gone a long way toward firmly fixing in the minds of the people generally that the Board of Agriculture and Forestry meant business in its enforcement of the terms of the forest fire law. A number of convictions have been secured, especially during the past three or four years, where fires had been allowed to escape through preventable carelessness. This action has had a salutary effect in certain sections of the Territory where the danger from fire was high.

Very fortunately Hawaii has suffered but little from forest fires. But in the leeward districts and in occasional dry years even in those normally subject to heavy rainfall, the danger of fire is always present. The time to make ready for fighting fire is before it starts. Hawaii is prepared.

RECOMMENDATIONS.

Just how soon it will be possible to establish a regular service of forest rangers, paid by and responsible solely to the Board of Agriculture and Forestry, is a question of financial policy. But until such a force of efficient men is organized to patrol the reserves, prevent trespass, see that the fences are maintained, exterminate the remaining wild stock in the forests, and prevent forest fires, the Hawaiian forest reserve system will not be properly administered. This is now the first need in forestry in Hawaii.

Next, the Territory is a long way yet from having enough grove and plantations of trees of economically valuable species. This is equally true of government and of privately owned land. Fuel supply in certain districts, fence posts, railroad ties, bridge timbers and other lumber for rough work, to say nothing of construction timber, will always be required in Hawaii. With the diminishing wood supply on the mainland the price of lumber will certainly not recede. It may make considerable advances. It has been demonstrated that there are trees well adapted to local conditions that can supply at least part of the local demand. It needs no argument to show the wisdom of establishing plantations of such species on land that cannot profitably be used for agriculture.

Along with the other forms of forest protection it is essential that the Territory keep up an efficient forest fire service. It will continue the duty of the Division of Forestry to see that the present forest fire organization is maintained, and when necessary expanded.

There are, as well, many lines of forest investigation which it should be the policy of the Board of Agriculture and Forestry to encourage. The introduction of species of trees new to the Islands, the experimental planting of temperate zone trees on the high mountains, and enough publicity and educational work so that the public shall be kept fully informed as to the necessity for forestry in the Islands and its needs, are all matters that should have attention.

The practice of forestry must always continue to be one of the important functions of the Territorial Government. On the foundation that has been laid in the past decade may the Division of Forestry build strongly and well.

Very respectfully,

Ralph S. Hosmer,

Superintendent of Forestry and Chief Fire Warden.

LIST OF DISTRICT FIRE WARDENS

Following is a list of the District Fire Wardens, with their respective districts:

CHIEF FIRE WARDEN.

Superintendent of Forestry, ex officio.

DEPUTY FIRE WARDEN AT LARGE.

DAVID HAUGHS.

In and for the Territory of Hawaii.

DISTRICT FIRE WARDENS.

KAUAI.

A. MENEFOGLIO.

In and for Wainiha Valley, District of Halelea.

W. F. SANBORN.

In and for the District of Halelea, excepting Wainiha Valley.

J. R. MEYERS.
GEORGE HUDDY.

Assistant District Fire Warden.

In and for the District of Koolau, excepting the land of Anahola.

GAYLORD P. WILCOX.

In and for the portion of the Districts of Koolau and Puna, extending from the land of Anahola to the land of Olohena, inclusive.

F. WEBER.

In and for the portion of the District of Puna, south of and including the land of Wailua.

FRANK A. ALEXANDER.

In and for that portion of the District of Kona, extending from the Hanapepe Valley to the Puna District line.

FRANCIS GAY.

In and for that portion of the District of Kona, lying between and including the Waimea, Poomau and Kauaikanana Valleys on the west and the Hanapepe Valley on the east.

AUGUSTUS F. KNUDSEN.

In and for the District of Na Pali and that portion of the District of Kona, lying to the west of Waimea, Poomau and Kauaikanana Valleys.

OAHU.

C. J. WHEELER.

In and for that portion of the District of Koolauloa from the Waialua District line to and including the land of Kaunala.

ANDREW ADAMS.

In and for that portion of the District of Koolauloa lying to the north and east of the land of Kaunala.

FRANK PAHIA.

In and for that portion of the District of Koolaupoko, extending from the Koolauloa District line to the land of Heeia.

OTTO LUDLOFF.

In and for that portion of the District of Koolaupoko, extending from and including the land of Heeia to the land of Kailua.

JOHN HERD.

In and for that portion of the District of Koolaupoko, extending from and including the land of Kailua to Makapuu Point.

CHARLES H. BAILEY.

In and for that portion of the District of Kona, extending from Makapuu Point to Palolo Valley.

JOSEPH K. KAPONO.

In and for Palolo Valley, District of Kona.

C. MONTAGUE COOKE.

In and for Manoa Valley, District of Kona.

W. M. GIFFARD.

In and for that portion of the District of Kona, lying between Pauoa and Manoa Valleys.

L. A. MOORE.

In and for Nuuanu Valley, District of Honolulu.

WALTER F. DILLINGHAM.

In and for that portion of the District of Ewa lying to the west of the main government road.

JAMES GIBB.

In and for that portion of the District of Ewa, lying between the lands of Moanalua and Waiawa.

H. BLOMFIELD BROWN.

In and for that portion of the District of Ewa lying to the east of the main government road between the land of Waipio and the Kaukonahua gulch.

W. M. TEMPLETON.

In and for that portion of the District of Waialua, lying between the Kaukonahua and Helemanu gulches.

GEORGE M. ROBERTSON.

In and for that portion of the District of Waialua, lying between the Helemanu and Opaeula gulches.

GEORGE WILSON.

In and for that portion of the District of Waialua, lying between the Opaelua Gulch and the Koolauloa District line.

F. MEYER.

In and for that portion of the District of Waianae lying to the west of the Waianae Mountains.

MOLOKAI.

JAMES MUNRO.

In and for that portion of the Island of Molokai lying to the west of Wailau Valley and the land of Mapulehu.

C. C. CONRADT.

In and for that portion of the Island of Molokai including and lying to the east of Wailua Valley and the land of Mapulehu.

LANAI.

GEORGE C. MUNRO.

In and for the Island of Lanai.

MAUI.

L. WEINZHEIMER.

In and for the District of Lahaina.

DAVID T. FLEMING.

In and for the District of Kaanapali.

ANDREW GROSS.

In and for the District of Wailuku.

F. F. BALDWIN.

In and for the District of Hamakuapoko and the west half of the District of Hamakualoa.

W. F. POGUE.

In and for the east half of the District of Hamakualoa and that portion of the District of Koolau lying to the west of Makapipi gulch.

WILBUR A. ANDERSON.

In and for that portion of the District of Koolau lying to the east of Makapipi gulch.

JOHN CHALMERS.

In and for the District of Hana.

....

In and for the District of Kipahulu.

....

In and for the District of Honuaula and Kahikinui.

L. VON TEMPSKY.

In and for the Districts of Kula and Kaupo.

HAWAII.

G. C. WATT.

In and for that portion of the north half of the District of Kohala extending from the land of Kaauhuhu to the Hamakua District line.

SAM P. WOODS.

In and for that portion of North Kohala, extending from the northern boundary of the land of Kawaihae I to and including the land of Kaauhuhu.

O. L. SORENSON.

In and for the District of South Kohala.

ALEXANDER MORRISON.

In and for the western part of the District of Hamakua extending to the west from the boundary of the land of Paauhau to the boundary of the land of Kukaiau.

DONALD S. MACALISTER

In and for that portion of the District of Hamakua, extending from and including the land of Kukaiau to the Hilo District line.

JOHN M. ROSS.

In and for that portion of the District of Hilo, extending from the Hamakua District to the land of Makahanaloa.

JOHN T. MOIR.

In and for that portion of the District of Hilo, extending from and including the land of the Makahanaloa to the land of Kikala.

JOHN A. SCOTT.

In and for that portion of the District of Hilo, extending from the Puna District line to and including the land of Kikala.

C. F. ECKART.

In and for the District of Puna.

WILLIAM G. OGG.

In and for that portion of the District of Kau, extending from the Puna District line to and including the land of Punaluu.

GEORGE GIBB.

In and for that portion of the District of Kau, extending from the land of Punaluu to the Kona District line.

R. VON S. DOMKOWICZ.

In and for that portion of the District of Kona extending from the Kau District line to and including the land of Kaapuna.

T. C. WHITE, **Acting.**

In and for that portion of the District of Kona, extending from the land of Kaapuna to and including the land of Hookena.

JOHN D. PARIS.

In and for that portion of the District of Kona, extending from the land of Hookena to and including the land of Kaawaloa.

T. C. WHITE.

In and for that portion of the District of Kona, extending from the land of Kaawaloa to and including the land of Kahaluu.

JOHN A. MAGUIRE.

In and for that portion of the District of Kona, extending from the land of Kahaluu to the Kohala District line.

Forest Rangers.

DAVID KAPIHE.

In and for that section of the Honolulu Watershed Forest Reserve, District of Honolulu, Oahu, bounded on the east by Manoa Valley, on the north by the Konahuanui Mountain Range, and on the west by Nuuanu and Pauoa Valleys.

Volunteers.

E. H. HIPPLE.

In and for Manoa Valley, District of Honolulu, Oahu.

CHARLES L. BEAL.

In and for the District of Honolulu, Oahu.

W. H. SHIPMAN.

In and for the Districts of Puna and Hilo, Hawaii.

DISTRICT FORESTERS

The names of the following gentlemen are borne on the rolls of the Board of Agriculture and Forestry as District Foresters. Those marked with a star have been appointed Special Territorial

Police Officers to enforce the terms of the Wild Bird Law, Act 104 of the Session Laws of 1907:

Kauai.

*Albert S. Wilcox, J. R. Myers, *F. Weber, Edward Broadbent. Rev. J. M. Lydgate, *Walter D. McBryde, *Francis Gay, *Augustus F. Knudsen.

Oahu.

*Andrew Adams, *L. L. McCandless, *John Herd, *Paul R. Isenberg, *Walter F. Dillingham, W. W. Goodale.

Molokai.

*James Munro, *C. C. Conradt.

Lanai.

Geo. C. Munro.

Maui.

L. Weinzheimer, F. F. Baldwin, *W. F. Pogue, *L. von Tempsky. Dr. J. H. Raymond, D. T. Fleming.

Hawaii.

*G. C. Watt, * A. W. Carter, * A. Ahrens, *John M. Ross, *John A. Scott, *Julian Monsarrat, Geo. Gibb, R. von S. Domkowicz, W. R. Castle, *John D. Paris, *John A. Maguire.

Report of the Acting Superintendent of Forestry

Honolulu, Hawaii, December 31, 1914.

The Board of Commissioners of
Agriculture and Forestry,
Honolulu, Hawaii.

Gentlemen:—I have the honor to submit herewith that part of the biennial report of the Division of Forestry for the period from September 1, 1914, to December 31, 1914, during which time I served at your direction as Acting Superintendent of Forestry after Mr. Ralph S. Hosmer's resignation from the superintendency.

Forest Extension.

The tree planting on that part of the Honolulu Watershed Forest Reserve, lying between Round Top Hill and the planted forest on Tantalus, including Sugar Loaf, has been continued to the end of the period. Up to December 31, 1914, a total area of 39 acres has been planted. Of the total number of 7885 seedlings set out, 6136 are Koa and 1749 are Kukui. Owing to favorable weather throughout the summer of 1914 we were able to continue planting and the seedlings got a good start and are doing well.

In September, 1914, I visited Kauai, and made final arrangements for planting the seed of the Chinese Plum (*Eugenia sps.*) on the Moloaa Forest Reserve at Anahola. The tract was examined and instructions given as to how the work should be done, the spacing to be 10 x 10 feet. The work of digging the holes and planting the trees was begun in October, and completed in December. At time of writing (Feb. 3, 1915), a report has been received from Mr. Kaina D. Lovell (who had charge of the planting) stating that he has examined the planted area, and found that out of the 18,900 holes planted, only between 50 and 60 trees failed to grow. This experiment will be watched with interest, and if it is found that certain bare areas within the forest reserves can be successfully covered with this tree at a cost of $10 per acre, which is approximately what this work has cost, it might be advisable to do more direct planting with this and similar species. The wood of this Eugenia makes good firewood, and it is also used to some extent for fence posts.

Final arrangements for the planting of a double line of trees along the boundary fence between the Koolau Forest Reserve and the Nahiku homesteads on Maui were agreed upon, and for this purpose 2,200 seedlings of *Eucalyptus robusta* were sent up from the Nursery in November. The work was undertaken by the manager of the Nahiku Rubber Company, Mr. W. A. Anderson, and was completed in December. Arrangements were similarly made with Mr. von Tempsky to plant trees on the Waihou Spring Forest Reserve near Olinda, Maui, and during November 2,500 seedlings, consisting half of *Grevillea robusta* in seed boxes and half of *Cryptomeria Japonica* (Japanese cedar) in transplant boxes were shipped from the Nursery for the work. At time of writing the work is reported to be progressing favorably.

For the purpose of doing similar work on Water Reserve B, Pupukea, Oahu, I visited the area in December, and made final arrangements with Mr. Mark Robinson, Jr., who agreed to undertake the work. A first shipment of 500 Ironwood trees has already been made and the work of planting is still in progress.

Forest Reserve Fencing.

The fencing off of the trail leading over the Kolekole pass in the Lualualei Forest Reserve at Waianae, Oahu, was completed in August. I made an examination of the fence at that time and found it substantially built and according to specifications. An examination of the fence running along the mauka boundary of the Lualualei Homesteads also showed that the repair work was satisfactory.

Dead Timber in Tantalus Forest.

In December a report was made on an application for the purchase and removal of the dead timber in the planted Tantalus Forest. The applicant offered to pay $1.50 per cord for the dead trees and limbs. My recommendations that cutting operations be not allowed in the forest during the rainy season on account of the damage that would be done to the roads was approved by the Board.

Arbor Day.

Arbor Day was celebrated on November 20, and proved to be very successful. The total number of trees distributed amounted to 17,595, which is nearly 6,000 more than for the year 1913. The trees were all pot grown, and with ordinary care ought to make a good growth. Arbor Day is getting more popular every year and more people are taking an interest in the planting and care of trees.

TABLES SHOWING THE NUMBER OF TREES PLANTED IN THE TERRITORY OF HAWAII, PRINCIPALLY BY CORPORATIONS, IN 1913 AND 1914.

Name of corporation	1913	1914	Total
KAUAI.			
Koloa Sugar Co.	11,199	5,901	17,100
McBryde Sugar Co.	17,839	17,839	35,678
Makaweli Sugar Co.	......	......	......
Lihue Plantation Co.	......	......	......
Papapaholahola Spring Reserve	18,544	20,381	38,925
	47,582	44,121	91,703
OAHU.			
Waialua Agricultural Co.	125,000	125,000	250,000
Honolulu Plantation Co.	......	30,000	30,000
	125,000	155,000	280,000
HAWAII.			
Kukaiau Ranch	99,450	165,920	265,370
Parker Ranch	33,832	96,394	130,226
Kukaiau Plantation Co.	2,000	2,000	4,000
Niulii Mill & Plantation	......	1,700	1,700
Honokaa Sugar Co.	10,000	10,000	20,000
Waiohinu Homesteads	......	2,000	2,000
Bro. Matthias Newell (sub-nursery, Hilo)	1,066	10,868	11,984
	146,348	288,882	435,320
MAUI, LANAI AND MOLOKAI.			
Maui Agricultural Co.	......	255,033	255,033
Wailuku Sugar Co.	19,661	29,261	48,922
Government Lands of Polipoli	4,653	11,187	15,840
Honolua Ranch	2,000	3,500	5,500
Cornwell Ranch	......	32,000	32,000
Lanai Company Ltd.	9,000	1,340	10,340
Haiku Homesteads	5,000	4,000	9,000
	146,348	288,882	435,230
Total number of trees planted on all islands	359,244	824,324	1,183,568

FORESTRY RULE I.

On August 22, 1914, the Governor, upon the recommendation of the Board, approved the following rule concerning the protection of the watersheds in Nuuanu and Makiki valleys within the Honolulu Watershed Forest Reserve:

RULE AND REGULATION OF THE BOARD OF COMMISSIONERS OF AGRICULTURE AND FORESTRY.

FORESTRY RULE NO. 1.

Concerning the protection of the Watersheds in Nuuanu and Makiki Valleys, Honolulu, T. H.

The Board of Commissioners of Agriculture and Forestry of the Territory of Hawaii, hereby make the following Rule and Regulation for the purpose of protecting from contamination the watersheds tributary to the Honolulu water supply system, within the boundaries of the Honolulu Watershed Forest Reserve:

Section 1. All persons or corporations are hereby prohibited from cutting or removing grass and other forage plants, except under such permits as may be issued from time to time by the Board of Commissioners of Agriculture and Forestry (1) from the government land in Nuuanu Valley, Honolulu, Oahu, lying within the boundaries of the Honolulu Watershed Forest Reserve, as established by a proclamation signed by Acting Governor E. A. Mott-Smith on October 13, 1913, which area, in part, includes the entire mauka portion of Nuuanu Valley above Luakaha; and (2) from all that portion of Makiki Valley, lying mauka of the Makiki Dam, on the government land of Makiki (also included in the above named forest reserve), as shown by registered map No. 2554, on file in the office of the government survey.

Section 2. Any person violating the above rule shall be guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine not to exceed Five Hundred Dollars ($500.00), as provided by Section 390 of the Revised Laws as amended by Act 82 of the Session Laws of 1905, and Act 112 of the Session Laws of 1907.

Section 3. This rule shall take effect upon its approval by the Governor.

Approved:

LUCIUS E. PINKHAM,
Governor of Hawaii.

Honolulu, Territory of Hawaii,
August 22, 1914.

Respectfully submitted,

DAVID HAUGHS,
Acting Superintendent of Forestry.

Report of the Forest Nurseryman

Honolulu, Hawaii, December 31, 1914.

Albert Waterhouse, Esq.,
Acting President and Executive Officer,
Board of Agriculture and Forestry.

Dear Sir:—I herewith submit a report of the work done during the years 1913 and 1914.

NURSERY.

Collection and Exchange of Seed.

The collecting of seed has been continued, and the two men employed have been kept busy at this work and at times assisted in packing up trees as well as collecting fruit and other material for the Entomologists. The seed collected in this manner is used for propagating purposes at the Government Nursery in Honolulu, and sub-Nurseries on the other Islands. The homesteaders and others all over the Territory are supplied with a reasonable amount of the locally collected seed free of charge, while the cost price is charged for imported seed which we buy from salesmen abroad. At the request of the officials of Botanic Gardens and other institutions in different parts of the world, we supply seed on the exchange system. In this way we are sometimes able to secure new and rare species which would be difficult to get otherwise. Tourists and others calling at the Nursery are often anxious to take away with them sample packages of seed. Those we supply with a few sample packages free.

A large quantity of seed collected by Mr. J. F. Rock while on a tour during the early part of 1913 was sown on its arrival and some of the species have already been planted out along the trail leading to Sugar Loaf Hill. Others are in pots at the station. It is too early to make a statement regarding these introductions. Some of them, however, are certainly looking well and are making a good growth.

The most promising introduction in the line of forest trees which we have been able to procure for a number of years is the *Juniperus cedar* of Jamaica, introduced by Mr. Gerrit P. Wilder, who sent us the seed while on a tour about four years ago. These trees have been distributed to people living at different elevations on the Islands, and reports are coming in that they are doing well. We planted a few of these Junipers along the new trail leading to Round Top Hill, and they are making a splendid growth. We have been able, through our exchange system, to procure more seed of the same, or an allied species of this Juniper (*Juniperus australis*) from Mr. William Harris, Superintendent of Public Gardens, Jamaica. Mr. Harris in his letter describes the *Juniperus cedar* as follows: "I now take pleasure in sending you two bags of seed of *Juniperus cedar* of Jamaica. It yields a beautiful timber, which is used in furniture, cabinet work, interior ornamental house work, etc. It grows in the mountains at from 3,000 to 5,000 feet altitude." The seed sent is germinating nicely, and we will have a large number of trees providing nothing unforseen happens.

PLANT DISTRIBUTION.

Distribution of Plants from Nursery and Makiki Station.

1913	In seed boxes	In boxes transplanted	Pot Grown	Totals
Sold Regular Distribution	7,800	1,880	3,101	12,781
Gratis	10,200	2,402	5,018	17,620
Street Planting	......	......	1,077	1,077
Homesteads	5,700	1,416	690	7,806
Military Posts	......	1,723	2,724	4,447
Schools	628	283	680	1,591
Parks	......	......	154	154
Clubs	......	......	776	776
Arbor Day	......	......	11,961	11,961
	24,328	7,704	26,181	58,213
Plantation Co.'s and other Corporations, etc.	451,620			451,620
				509,833
1914				
Sold	6,250	1,301	3,938	11,489
Gratis	10.700	7,041	7,853	25,594
Street Planting	6,000	100	196	6,296
Homesteads	12,750	3,400	1,422	17,572
Military Posts	1,000	550	5,138	6,688
Schools	......	125	1,160	1,285
Clubs	......	850	1,330	2,180
Arbor Day	......	......	17,575	17,575
Gov't Forest Reserves	1,250	3,450	7,885	12,585
	37,950	16,817	46,597	101,364
Plantation Co.'s and other Corporations, &c.	81,850	13,450	1,573	96,873
	119,800	30,267	48,170	198,237

TOTAL PLANT DISTRIBUTION.

	1913	1914	Totals
Nurseries on Oahu	509,833	198,237	708,070
Sub-Nursery, Homestead, Kauai	6,500	7,977	14,477
Sub-Nursery, Hilo, Hawaii	1,066	10,868	11,934
	517,399	217,082	734,481

Propagation of Trees for Plantation Companies and Other Corporations.

The propagation of trees in large quantities for plantation companies and other corporations has been continued during the period. By this system, which was started about four years ago, companies and other corporations desiring large quantities of trees are required to pay the cost of labor and material in supplying the required seedlings. The majority of the trees ordered are shipped in seed boxes ready to transplant into other boxes or pots. As the seedlings are past the damping off stage before they are sent out there is no trouble in transplanting them, and any careful laborer can do the work. During the past two years we have distributed the following trees to plantation companies, etc.:

	In seed boxes.	In transplant boxes.	Pot Grown.	Total.
1913	451,620	.....	.....	451,620
1914	81,850	13,450	1,573	96,873
Total	533,470	13,450	1,573	548,493

There is every indication that large numbers of trees will be set out by plantation companies during the early spring of 1915, as we are already receiving orders for quantities of seedlings to be delivered during February and March.

Although we generally have in stock a reasonable number of the species which are in demand both in seed boxes and transplant boxes, we would again urge on those who require large quantities of trees to notify us in advance so that we will be sure to have the trees ready when required. The time required to get seedlings ready for transplanting is from one month to six weeks and for transplants ready to set out from two and a half to three months.

This system of supplying trees in large quantities to plantations and corporations has worked well and there is no doubt has been the means of adding considerably to the number of trees planted.

GOVERNMENT REALIZATIONS.

1913.

Sale of Plants	$ 76.30	
Sale of Seeds	4.55	
The Board's share of the proceeds of sale by the Waterworks Department of Automobile owned jointly by the Waterworks, Public Works and Board of Agriculture and Forestry, bought by Mr. Marston Campbell, July, 1909, when acting as Superintendent of Public Works, Commissioner of Public Lands and President of the Board of Agriculture and Forestry	437.50	
Rent of Building, Nursery Grounds	437.50	$619.75

1914.

Sale of Plants	$ 80.75	
Sale of Seeds	8.00	
Rent of Building, Nursery Grounds	455.00	
5 Coils Fence Wire	11.15	
Freight on Plants	.50	$555.40

COLLECTIONS ON ACCOUNT OF PRESERVATION AND EXTENSION OF FORESTRY AND FOREST RESERVES.

The following amounts have been deposited with the Treasurer as a Special Fund under the above heading:

Rent of premises at Half Way House, Tantalus, at $10 per month, April 1 to Dec. 31, 1914	$ 90.00	
Permit to cut grass, Tantalus Forest, at $20 per month, July and August, 1914	40.00	
For use of two acres of land (Kalawahine), Pauoa Valley, at the rate of $10 per year, April to Dec., 1914	15.00	
Fee for use of land and gathering Ti leaf on Kalawahine, Pauoa Valley, at the rate of $50 per year, June 1st, to Dec. 31st	37.50	$182.50

OTHER WORK

Nursery and Grounds

The work at the Nursery has been carried on with the assistance of one man whose principal work consists of potting and packing up trees. One man, employed by the Board, with the assistance of two prisoners, has attended to the grounds around the offices and also to the Park portion of the nursery grounds.

There is great need of a stone curb along the King Street side of the Nursery grounds. The wooden curb, laid many years ago, is practically all rotted away and without a curb the sidewalk looks disreputable.

We wish to extend our thanks to the High Sheriff for the interest taken and the assistance given us by supplying two

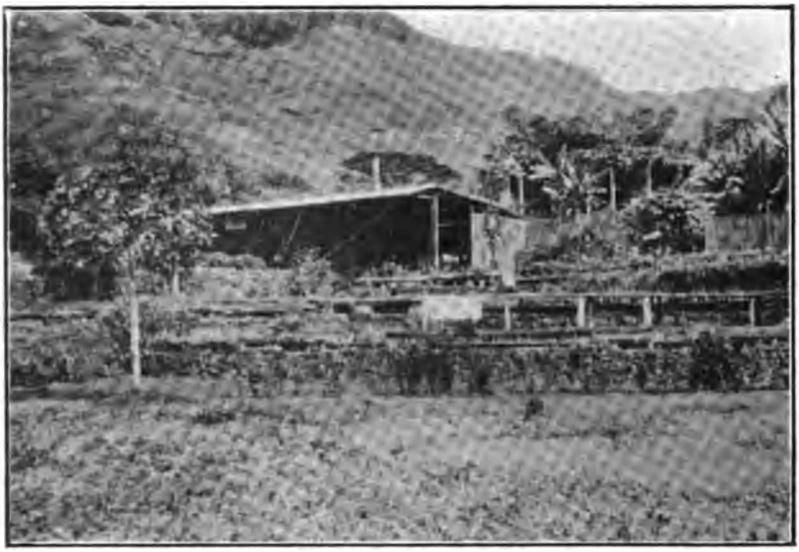


Plate 5. Fig. 1. **Plants for Distribution, Makiki Nursery.**

Plate 5. Fig. 2. **Soil Sterilizing Shed, Makiki Nursery.**

trusties, for with their help it would be impossible for us to keep the grounds in good condition.

Congressional Vegetable Seed and Year Books.

During the month of December 1912 we received from Washington, D. C., through Honorable J. K. Kalanianaole, Delegate to Congress, 10,000 packages of vegetable seed and 500 packages of flower seed. The above consignment was all distributed during the year 1913; a similar supply was received in December 1913 for distribution during 1914. This seed was sent out to public schools, homesteaders and others all over the Islands.

Copies of the Year Book of the U. S. Department of Agriculture, also sent by the Delegate, are distributed annually to a list of people interested, throughout the Islands. Seven hundred and fifty books is the quota received.

Advice and Assistance

This branch of the work takes up considerable of the writer's time. Calls are made from time to time at the different Military Posts on Oahu, where a great deal of planting of trees, shrubs and vines is going on. The effect of this planting will, in a few years, show to good advantage, as most of the sites of these posts were without shade or shelter with the exception of a tangle of lantana, glue bush and weeds.

Advice and assistance has been given to the Out Door Circle of the Kilohana Art League Improvement Club, School Officials, and others. Advice by letter is given to people on the other islands and assistance and advice is given to people who make requests by telephone and who call at the nursery personally. The number of these requests has increased considerably during the past two years due principally, there is no doubt, to the increased population, the desire by the officers and men of the different Military Posts to beautify their surroundings, and the general cooperation of individuals with the civic organizations for the beautifying of their respective districts.

Makiki Station

At the station the work of mixing and sterilizing all the soil used there and at the main Nursery is done. The steam sterilizer, installed about three years ago, has done excellent work. A great deal of the transplanting and potting of trees is done at this station. All the new introductions, after being started at the main nursery are sent to this station and grown in pots until they become large enough to be set out in a permanent position.

Along the trail leading up to Sugar Loaf Hill samples of the new introductions have been planted including the Juniperus cedar, introduced by Mr. Gerrit P. Wilder. This station is well situated and owing to the greater moisture, is better adapted for the propagating of some species than the Nursery. We have got a good road now, and the transfer of plants and soil is an easy matter.

There is a large area of land around the station which we are gradually getting planted with trees. A collection of bamboos imported from Japan about four years ago, with few exceptions is doing well.

The Basket willow is also doing very well. About a year ago we received cuttings of five varieties of Basket willow from Washington and with the exception of two they are doing very well. The variety brought here by Dr. L. R. Gaspar from Portugal, and handed to us by the late A. de Souza Canavarro, Consul General for Portugal has done exceedingly well. A great many cuttings of this variety have been sent to selected people on different parts of the Islands. More cuttings are now ready and we will be glad to fill orders providing the applicants are willing and agree to pay the freight or postage.

Tantalus Forest

During the summer of 1913 the dead wood was all removed from the forest for which the sum of $55.00 was realized. This amount was deposited with the Treasurer as a realization. During the month of August and September, 1914, 25 trees, 5 each of the following species were cut down: *Eucalyptus cornuta, Eucalyptus citriodora, Eucalyptus calophylla, Eucalyptus robusta* and *Eucalyptus globulus.* These were split up into fence posts and sent to the College of Hawaii to be tested as to their durability. A report of the finding will be furnished the Division of Forestry when complete.

During the months of July and August, 1914, the privilege to cut grass and honohono in the forest was granted to Mr. Farm Corn at a monthly rental of $20.00. Previous to that time complaints had been coming in about people carting away the grass (and cutting up the road) without permission. An effort was made to stop this unauthorized cutting of grass and honohono but as the grass cutters had permission to cut grass on lands not controlled by us and of course had to pass through the forest to get this grass, they would at times, when the ranger was not around, fill their wagons from the forest. Hence the reason for giving a permit to one man. Mr. Farm Corn discontinued the cutting of grass in the forest at the end of August and there has been no other permit granted.

The forest is in fairly good condition and with the exception

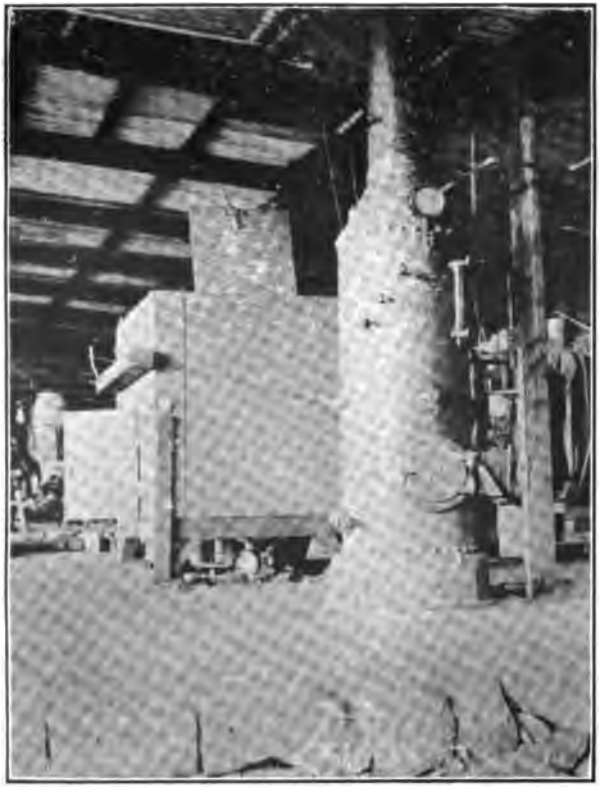


Plate 6. Fig. 1. **Soil Sterilizer, Makiki Nursery.**

Plate 6. Fig. 2. **Tin Can Cutter at Makiki Station.** Prepares can for tree pots.

of a few dead trees that require to be removed, and the thinning out of parts where the trees are getting crowded, there is little else required at this time.

The ranger, David Kapihi, has done good work in patrolling the forest and keeping the trails clear. There have been no fires in the vicinity of the forest during the period.

Honolulu Watershed Planting

A commencement was made in July 1913 on the arrangements for the planting of Koa and Kukui trees on that portion of the Honolulu Water Shed lying between Round Top Hill and Tantalus Forest including Sugar Loaf Hill. The first work in connection with the planting was the making of trails. A new trail was made from the Makiki Station along the ridge on each side of Herring Valley and leading up to the base of Sugar Loaf Hill where a location for a small nursery was selected. A new trail was started from this point running across the face of Sugar Loaf Hill and connecting with the Round Top trail. Another trail from the small nursery and running across the head of Opu Valley was built so that trees could be packed over to the Round Top side of Opu Valley, also, as a convenience for the men while at work. These trails will all be necessary as a protection in case of grass or brush fires and ought to be kept clear during the dry season at least.

At the small nursery at the base of Sugar Loaf a shed, 12 x 24 feet, with accomodations for tools, water barrels and a space for men to do potting and other work during heavy rains, had to be built. The material for this shed which is constructed of corrugated iron and 2 x 4 scantlings, was, with the exception of a few sheets of roofing iron, taken from the forestry buildings in Nuuanu Valley. The material was carted to the Makiki Station and from there carried by the men along the new trail to the base of Sugar Loaf Hill. Water barrels for storing water for sprinkling the young trees in the nursery had to be packed in the same manner as there is no wogan road near.

The actual planting of trees commenced on the face of Sugar Loaf Hill on October 1, 1913. All of the hill was planted in *Koa* with the exception of about 200 *Kukui* trees planted near the bottom. The work of filling up all the waste spaces lying between Round Top and Tantalus is progressing and in a short time this part of the Reserve will have a different appearance and will be of much more value as a watershed. The area now planted is 39 acres. The number of trees planted up to the end of December 1914 is as follows:

Koa	6,136
Kukui	1,749
Total	7,885

These trees will require to be kept clear of grass and weeds until they get above the long grass and brush. A good many of the trees first planted are at the date of writing from four to six feet high.

Respectfully submitted,

DAVID HAUGHS,

Forest Nurseryman.

Report of the Consulting Botanist

Honolulu, Hawaii, December 31, 1914.

The Board of Commissioners of Agriculture and Forestry,
Honolulu, Hawaii.

Gentlemen:

I herewith present my report on the work carried on during the biennial period beginning January 1st, 1913 and ending December 31st, 1914, in my capacity as Consulting Botanist.

The writer's connection with the Forestry Division as an active staff member was severed on September 1st, 1911, but he was immediately appointed by your Board to the position of Consulting Botanist, in which capacity he has given advice and has assisted in the introduction of useful plants into this Territory. On the most noteworthy work of this nature he will report in the following lines.

In the earlier part of 1913 the writer was engaged in writing his book on the Indigenous Trees of the Hawaiian Islands, which was based mainly on the material collected by him under the auspices of the Board of Agriculture and Forestry. The volume, containing 530 pages with 215 plates, appeared June 26, 1913. The money necessary for the publication of the book in question was subscribed by some of our very liberal citizens.

About the same time there was issued by the Board of Agriculture and Forestry, Botanical Bulletin No. 2, entitled: "List of Hawaiian Names of Plants," by J. F. Rock. This bulletin comprises a most comprehensive list of all Hawaiian names of plants of all types, including mosses, lichen, sea weeds, herbs, shrubs, and trees which information was secured by the writer while in the employ of your Board.

At the request of the President of your Board the writer compiled an extensive article on the forest covering of all the islands of the Hawaiian group, the manuscript of which now awaits publication. The writer would recommend the same to be published as Bulletin No. 3 of your Board, because he has received many inquiries from various institutions throughout the United States asking if the introduction in the writer's book on the Indigenous Trees of Hawaii has been printed separately. The article furnished by the writer on the forest covering of the islands of the Hawaiian group is in a great measure the same as his introduction in the book on trees, only it has been enlarged and does not discuss the group collectively; but each island, with its various zones, has been discussed separately and in an appendix a review is given of the plant families which are predominant in the forests of these islands, stating their percentage in each of the various zones.

On July 3, 1913, the writer left Honolulu on an exploration trip to the Island of Palmyra, at the invitation of the Hon. Henry E. Cooper. Much material was collected, especially seed of the two new species of *Pandani* (Screw pines) which are now thriving well in this Territory.

In the month of September, 1913, the writer was especially commissioned by your Board as scientific explorer for the purpose of collecting seeds of useful as well as ornamental plants, and introducing the same into this Territory. On September 13, 1913, the writer started on his trip around the world at his own expense, permission having been given him by the Board of Regents of the College of Hawaii to carry on investigations in the various herbaria of Europe. He was properly commissioned to that effect. He was also commissioned by the United States Department of Agriculture as Collaborator of the Bureau of Plant Industry for the purpose of collecting or causing to have collected seeds of various plants, especially bamboos from the lower forests of Sikkim.

The writer proceeded on the U. S. Army Transport "Thomas" to Manila, Philippine Islands, via. Guam, in which latter place he collected seeds of various trees during his brief stay in that port.

While in the Philippines the writer spent some time with the officers of the Forest School at Los Banos, ascending Mt. Maqueling, where he collected a large quantity of seeds, as well as in the fine natural arboretum around Los Banos Forestry Station. He then proceeded with several members of the Philippine Forestry staff to Batan Province, Luzon, where Mt. Mariveles was partly ascended and seeds collected, which, with instructions in regard to planting, were forwarded to Honolulu.

From the Philippines the writer embarked for Hong Kong and Canton, China. In the former place arrangements were made with the Director of the Botanic Gardens to forward seeds of Chinese conifers and *Araliaceae* to Honolulu.

In Singapore the writer was the guest of the Director of the Botanic Gardens, who helped him greatly in collecting the seeds of many of the wonderful plants found in that renowned garden. The result was the forwarding of a box of seeds of many species of palms and large trees, a good many of which are now growing at the Government Nursery.

From Singapore the writer proceeded to Johore, Penang and Rangoon. Unfortunately the writer was taken ill at Penang, which prevented him from carrying out his plans in that region. From Burmah he sailed for Calcutta and from there took the train for Darjeeling, the summer residence of the Bengal Government in the lower Himalayas at an elevation of 7,000 feet. In this most wonderful of all regions the writer stayed a month, making various journeys into the hills. He employed several Nepalese and Tibetans, instructing them to collect seeds of as many forest trees as they could find. As the trees found in this region are of a more temperate climate, they were intended for planting on some of our high mountains, such as Mauna Kea and Mt. Haleakala. Seeds of not less than 82 species of trees and shrubs were collected in these magnificent hills and were forwarded to Honolulu. Arrangement was made to have collected a large amount of seeds of a giant bamboo (*Dendrocalamus Hamiltonii*) growing in the Teesta valley and in the lower regions of Sikkim. This bamboo was desired by the U. S. Department of Agriculture for the purpose of experimental planting along the Panama canal. It is one of the bamboos which flowers and fruits abundantly nearly every year. Over a large area this bamboo was in flower during the writer's visit in that district.

At Calcutta the writer secured the help of the Director of the Botanic Garden at Sipbur in regard to the collecting and forwarding of seeds of valuable trees and shrubs and he has since been informed by Mr. Haughs of the Board of Agriculture that seeds have already been received from that garden.

From Calcutta the writer journeyed through the whole of Northern India, visiting the districts of Benares, Agra, Delhi, Lahore in the Punjab and from Rawal pindi, the junction to Kashmere to Peshawar in the northwest frontier province. There he secured a pass from the residing political agent which enabled him to cross the mountains intervening between British India and Afghanistan by way of the famous Khyber pass.

The mountains there are extremely arid and barren; in the Khyber proper he found trees of an Acacia and other leguminous shrubs which reminded him very much of the Algaroba; seeds were secured but unfortunately they never arrived in Honolulu. From the extreme northwest corner of India the writer traveled across to Bombay, Central India, Hyderabad in the Deccan, and via Madura to Tuticorin in the extreme south of India, embarking there for Ceylon. Shortly after arrival at Colombo he proceeded to Kandy, the old Singhalese capital, spending most of his time in the famous botanic gardens at Peradenya, collecting seeds.

At Colombo the writer embarked for Egypt, where he visited the sugar producing districts and the largest sugar mill in the world near Assiut. He collected seeds of many plants below Assuan, along the Nile. The most notable introduction into our

Territory from there is the Dom palm *(Hyphaene thebaica)*, one of the very curious fan palms that branches like a Pandanus. It is known as the Ginger bread tree, as its fruit, which is edible, savors of ginger. The seeds brought back by the writer have already germinated and the young plants should be planted in a conspicuous place in some park or at the Nursery grounds, where they can readily be seen.

After journeying through Algeria and collecting in the Atlas mountains, especially near El Kantara, the writer visited the famous oasis Biskra, with its wonderful date palm gardens, journeying south to the great oasis of Tuggurt in the land of the dunes.

From Algeria he went straightway via Italy to Berlin where he spent most of his time at the Royal Botanical Museum working up the Hillebrand collection, making drawings of the types, etc. For the purpose of determining some of the more difficult Hawaiian genera, Herbarium material was forwarded from Honolulu to Berlin, which the writer compared with the Hillebrand, Wawra, and Chamisso collections at the Royal Botanical Museum. The authorities of the latter institution presented the Herbarium with almost a complete collection of Hawaiian plants, containing portions of types and co-types from the Hillebrand collection. This, with the co-types from the Asa Gray collection, generously given by the Gray Herbarium, Cambridge, Massachusetts, makes the Herbarium of your Board, now in the safe keeping of the College of Hawaii, the most complete and valuable collection of Hawaiian plants in the world.

Respectfully submitted,

JOSEPH F. ROCK,

Consulting Botanist.

Division of Hydrography

Report of the Superintendent of Hydrography

Honolulu, Hawaii, December 31, 1914.

The Board of Comissioners of Agriculture and Forestry,
Honolulu, Hawaii.

Gentlemen:

The following report of operations of the Division of Hydrography for the biennial period ending December 31, 1914, is submitted:

The hydrometric work of the Territory of Hawaii during this biennial period has been carried on in cooperation with the U. S. Geological Survey. During the period January 1 to June 30, 1913, the Territory was represented by the Superintendent of Public Works, and the Conservation Board which made financial allotments to be used in cooperation with the annual federal allotment. Since July 1, 1913, the work has been carried on under the provisions of Acts 56 and 57 of the 1913 Legislature of the Territory of Hawaii, which are as follows:

ACT 56.

Section 1. The Board of Agriculture and Forestry is hereby authorized to create and maintain a Division of Hydrography for the investigation and determination of the water resources of the Territory by the gaging of streams and rainfall and other means, in cooperation with the United States Geological Survey or otherwise, and in furtherance thereof, to take over and exercise the functions of the Territory in the conduct of the present hydrographic survey of the Territory.

Section 2. This Act shall take effect on July 1, 1913.

ACT 57.

Section 1. All revenues derived from water licenses during the period beginning July 1, 1913, and ending June 30, 1915, whether by way of rentals or otherwise, shall constitute and be held as a special fund in the treasury of the Territory, to be disbursed on warrants of the Auditor issued on approved vouchers of the President of the Board of Commissioners of Agriculture and Forestry. Such moneys shall be apportioned and applied from time to time by the Board of Commissioners of Agriculture and Forestry, acting with the approval of the

Governor, equally between the Division of Forestry and the Division of Hydrographic Survey to the following purposes, and not otherwise:

1. For the protection of forest reservations, established or set apart according to law, against damage by fire, animals and otherwise by means of fences and any other means whatsoever, and for the expenditures of the Division of Forestry.

2. For the development and maintenance of the hydrographic survey throughout the Territory. Each voucher against said fund shall designate the general purpose for which it is drawn.

Section 2. This Act shall take effect on July 1, 1913.

Under the authority given by Act 56, the following agreement was signed by the Governor at Honolulu and the Director of the U. S. Geological Survey at Washington, D.C.

This agreement made this 26th day of June, 1913, by and between the United States Geological Survey by George Otis Smith, Director, party of the first part, and the Territory of Hawaii, by W. F. Frear, Governor, party of the second part:

Witnesseth:

1. The parties hereto covenant and agree that, in accordance with their respective statutory authorities, copies of which are attached hereto, there shall be maintained in cooperation an investigation of the water resources of the Territory of Hawaii.

2. That the parties hereto shall contribute for the purpose of carrying on these investigations and for preparing the results thereof for publication the following amounts: (a), the party of the first part, five thousand dollars ($5,000.00) to be expended during the fiscal year ending June 30, 1914; (b) the party of the second part not less than fifteen thousand dollars ($15,000) to be expended during the same fiscal year, it being understood that the contribution of the United States Geological Survey is dependent upon Congressional appropriations for carrying on these investigations.

3. The areas to be investigated and the scope of the investigations shall be determined by mutual agreement between the parties hereto and their respective representatives.

4. The areas to be investigated and the nature of the investigations having been determined, the field and office work necessary therefor shall be under the direction of the party of the first part, who shall by a duly accredited representative, supervise the expenditure of the funds contributed by both parties and shall approve vouchers for all such expenditures. The methods of investigation and the regulations governing them shall be those usually followed by the party of the first part, provided that they may be subject to such modifications as is suggested by the party of the second part, and approved by the party of the first part.

5. During the progress of the work all records pertaining thereto shall be open to the inspection of the party of the second part, and if the work is not being carried on in the manner satisfactory to the party of the second part, he may, on formal notice, terminate this agreement.

6. Accounts of expenses incurred in the performance of the work herein provided shall be rendered monthly in the manner required by the laws and regulations of the parties' hereto and shall be paid in accordance therewith.

7. Certified copies of all results of investigations shall be fur-

nished to the party of the second part on demand. The original records should ultimately be deposited in the office of the party of the first part and shall become part of the records of said office.

8. The results of the work contemplated in this agreement shall be published by and in the regular annual reports of the party of the first part, and said publications shall contain a statement of the cooperative relation between the parties thereto. The cost of publication shall not be included in the contributions herein provided by the parties to the agreement. The party of the second part reserves the right to publish all results of said investigations, it being understood that at least sixty (60) days shall be given the party of the first part for the proper assembling and compiling of any data desired for such territorial reports.

In witness whereof, we have hereunto set our hands and seals this 26th day of June, in the year one thousand nine hundred and thirteen.

(Sd.) GEO. H. ASHLEY,
Acting Director, for and on behalf of the United States Geological Survey, Party of the First Part.

(Sd.) W. F. FREAR,
Governor of Hawaii, for and on behalf of the Territory of Hawaii, Party of the Second Part.

The work is being carried on during the present fiscal year in accordance with the specifications outlined in the above agreement, no written agreement being deemed necessary.

SCOPE OF WORK.

The primary results worked for are:

1. An accurate knowledge of the actual fresh water resources of the Territory, including privately owned water as well as government water. This knowledge includes the daily mean maximum, daily mean minimum, and daily mean discharge, or runoff, of all water sources. It also shows the extreme flood peaks of streams even when these are only of a few hours duration. Experience has shown that at least fifteen years, and preferably a longer period, of continuous records of the flow of a stream are necessary to obtain a close estimate of the extreme low and flood discharge.

2. A knowledge of the amounts diverted from both privately owned and government sources, in order that the question of further developments or improvements of existing diversions may be intelligently considered. In many instances government water is leased by private parties, and an accurate knowledge of the number of million gallons obtained is absolutely necessary that an equitable agreement as to price paid, may be reached.

3. A knowledge of the efficiency and economy of existing diversions, of seepage and leakage losses from ditches and flumes.

4. A knowledge of possible future development and utilization of water now being wasted. This includes possible irrigation, power and domestic water-supply projects in relation to planta-

tions, to homesteads, and to Honolulu's, Hilo's, and other city or community supplies.

WORK ACCOMPLISHED.

All of the larger and most valuable streams and springs have been under investigation to some degree, but from a general view-point it may be said that the work is just well begun.

The work may be divided into two phases—the constructive or establishment stage, and the operative stage. The first is, of course, the more costly and requires the purchase of equipment and materials, the building of trails, the transportation of heavy materials, the employment of labor under necessarily adverse conditions of location and living conditions.

The second stage of operation requires less cost and a smaller organization.

It is estimated that the construction work for the islands of Kauai, Oahu, and Maui is more than half completed, while on the islands of Molokai and Hawaii, practically no work has been done. The operative and maintenance work has followed closely the construction work.

UTILIZATION INVESTIGATIONS.

The work of measuring utilized water in ditches, flumes, pipes, etc., has progressed very rapidly during the calendar year 1914, and sufficient information has been obtained to show that there has been a great variation in the rentals received from both government and privately leased water when considered from a quantitative view-point. It is planned that this class of the work receive even greater attention during the coming biennial period and that an accurate knowledge of the amounts in million-gallons furnished to each lessee or user of government water be determined.

In August, 1914, a proposal was made by this Division to the Director of the Hawaiian Sugar Planters' Association Experimental Station to the effect that this division would investigate ditch and flume seepage and leakage losses from existing systems as well as efficient water distribution and application problems, if the persons or corporations concerned would pay the actual expenses of equipment, materials, labor, transportation, subsistence, etc., incident to these investigations, and with the understanding that the data obtained be published in public documents for the benefit of all water users. This proposal has been accepted by eight plantations and one power company, and the work was started in September by investigating the main, lateral, and level ditch seepage and priming losses at the Waipio substation.

Plate 7. **A typical stream during high water. The Wailuku River below Rainbow Falls, Hilo, Hawaii.**

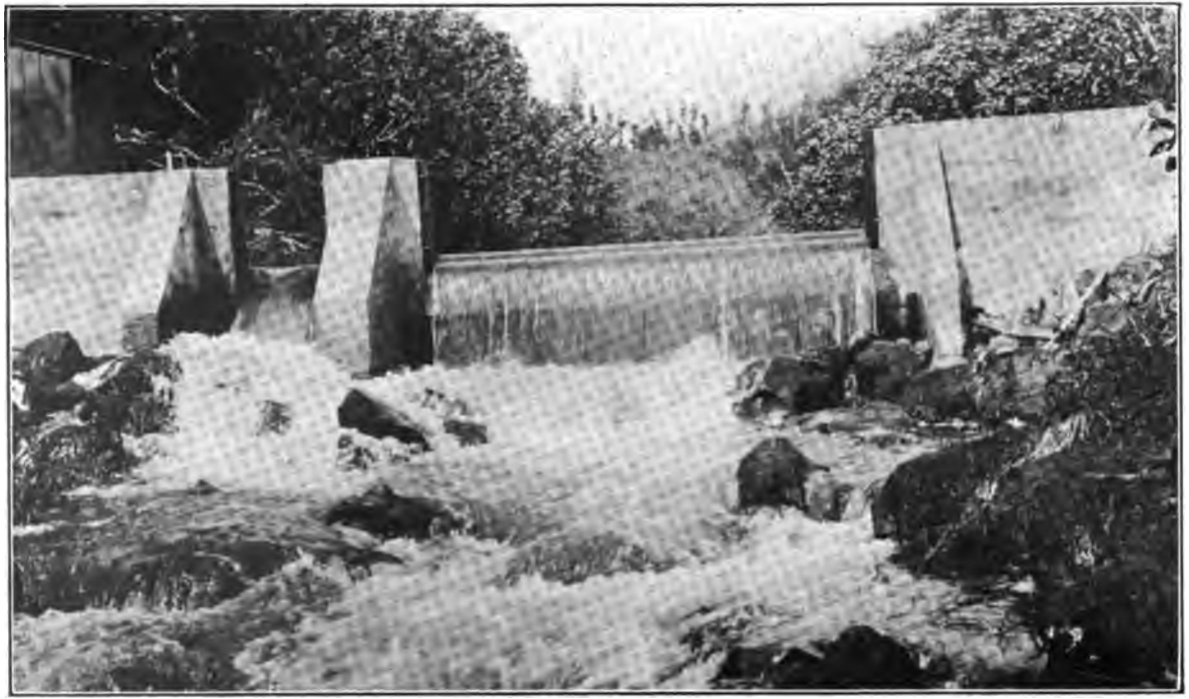


Plate 8. **A Weir Station. Nuuanu Stream at 650 feet, Honolulu, Oahu.**

COOPERATIVE WORK.

In addition to the work carried on from Federal and Territorial funds, the following work was done in cooperation with the U. S. Army and with private corporations on Oahu:

Three continuous water stage register measurement stations were constructed in connection with the water-supply system of Schofield Barracks.

Twenty-five small stream and ditch measurement stations were established in the Kailua, Kaneohe, and Heeia valleys in cooperation with the Kaneohe Ranch Company and the Heeia Agricultural Co. to determine the amounts furnished to various lessees.

Seven continuous water stage register measurement stations were established on the properties of the Kahuku and Laie Plantation companies, and the Wahiawa Water Company. Five of these stations were established for the plantation companies to determine the flood run-off of streams which have little or practically no flow under dry weather conditions. These data will determine whether storage of flood water will be justified. The two stations established foı the Wahiawa Water Company are used to determine the discharge in the streams immediately above the ditch intake.

One measurement station was established to measure the discharge developed in the Waiahole Tunnel, by the Waiahole Water Company.

On Kauai the Hawaiian Sugar Co. has furnished a continuous water stage register and at the present time a measurement station is being established on the Olokele River to measure the water left in the stream below the ditch intake.

In all instances the cost of all equipment, materials, labor, transportation, subsistence, etc., has been paid by the cooperating party while this Division has furnished the services of the engineer free of cost.

In addition to the above cooperation many plantations, water companies, and individuals are furnishing stream run-off and rainfall records which, with those of the other cooperative parties, are published in public documents.

HONOLULU WATER SUPPLY.

All surface water supplies, including springs, which might be considered in connection with Honolulu's water supply, have been under investigation for the greater part of the past year. The artesian well investigation being carried on under the direction of the Department of Public Works has also kept a record of the underground water supply. During the year measurements were made of the waste water from artesian wells.

An investigation of the utilization of all water, both surface and underground, in the Honolulu basin, that is, between Fort Shafter and Diamond Head was started in November, 1914. This investigation should not only show the amount of water available, now being utilized, and now being wasted—but should give an approximation of the value of the water.

KONA, HAWAII, INVESTIGATION.

The 1913 Territorial Legislature appropriated $5,000.00 for a special investigation of the surface water resources of the districts of North and South Kona, Island of Hawaii, to be made by the Division of Hydrography and to be completed previous to the meeting of the 1915 Legislature. The act provided not only for the measurement of surface water supplies, but for the measurement of rainfall, for topographic surveys of possible storage sites, and for estimates of costs and recommendations as to future development of water storage and distribution systems. This investigation has been completed at a cost of about $3,000,00, and the report thereof will be furnished to the 1913 Legislature. The Bernice P. Bishop Estate cooperated in this investigation to the extent of approximately $200.00 value furnished as transportation, loan of equipment, services of guide, etc.

SPECIAL INVESTIGATION WORK.

A large amount of miscellaneous special investigation work has been done during the biennial period, which includes preliminary investigation and cost estimates of power development and irrigation projects on Oahu, the checking up of weir formulae by current meter measurements, and the investigation of possible contamination from sewage, of artesian water supplies for domestic purposes.

WINDWARD KAUAI WATER.

The group of five streams consisting of the Wainiha, Lumahai, Waioli, Hanalei, and Kalihiwai streams on windward Kauai probably discharge more than forty per cent of the total dry season discharge of all Kauai streams. The Wainiha and Hanalei rivers have the greatest low water discharge of all Hawaiian streams. A very small part of these waters are now being directly utilized for irrigation. Practically all of the low water discharge of the Wainiha is used to develop electric power which is carried by power line over the mountains to the leeward side, and is then used principally for pumping ground water for irrigation.

It is estimated that these five streams have a minimum dis-

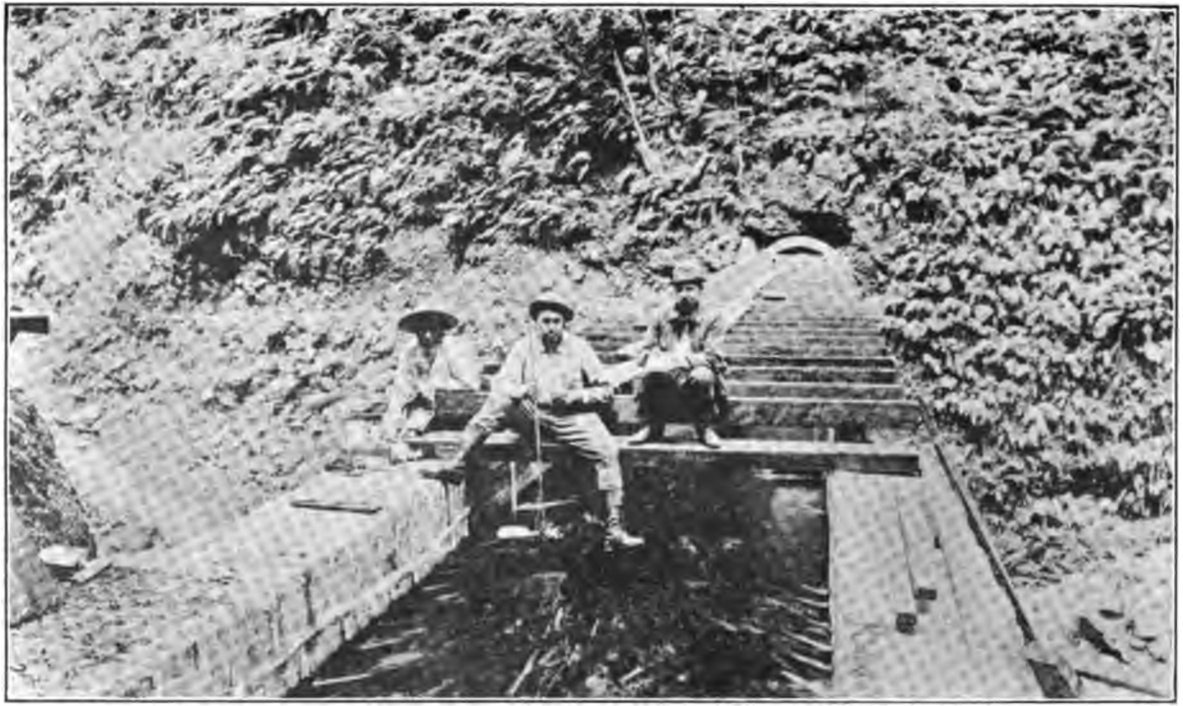


Plate 9. Hydrographer ready to make discharge measurement with current meter and rod. New Hamakua Ditch, Hawaii.

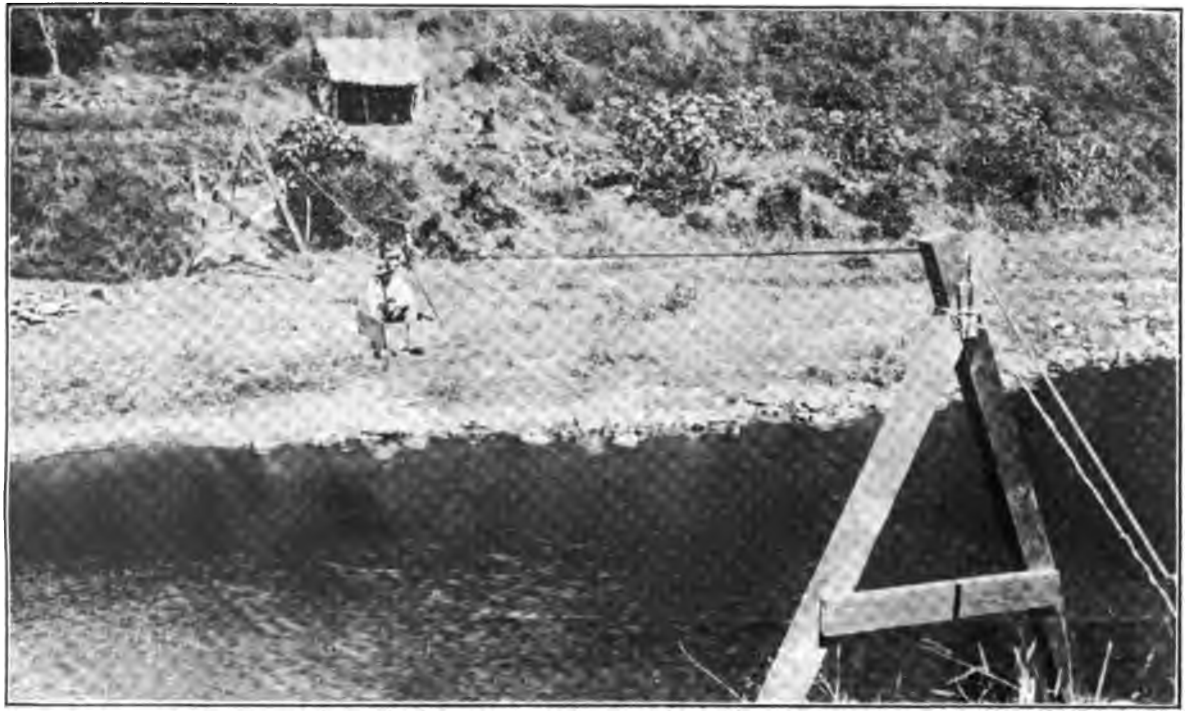


Plate 10. Hydrographer making a high water discharge measurement from standard gaging car and cable. Hanapepe Stream, Kauai.

charge at an elevation of 750 feet above sea level, of more than one hundred million gallons per day, while the discharge at an elevation of about 300 feet above sea level, and above all existing taro and rice irrigation, is at least one hundred and fifty million gallons per day. It is believed that the total discharge could be diverted at the 750 feet level and still have an abundance of water for all claims below.

Preliminary estimates lead to the belief that a gravity irrigation project could deliver the waters of these streams to the plantations and homesteads of leeward Kauai at a much cheaper rate per million gallons than that which is now being paid for pumping operations.

With this object in view, continuous record register measurement stations have been established on these five streams above the 700 feet level to determine the discharge of each of these streams. Two of these streams, the Hanalei and Waioli are owned by the government and, should this project develop, the revenues from these sources to the government should be considerable.

RAINFALL MEASUREMENT STATIONS.

The U. S. Weather Bureau publishes only rainfall data which may be obtained from daily readings. In order that the amount of rainfall on high ridges and at practically inaccessible localities might be obtained, a type of rain gage was designed which could be read at monthly or bi-monthly intervals. To measure the evaporation which must be lost from these gages during these long periods an evaporation measurement gage was also designed.

Monthly and bi-monthly rain gages with evaporation gages have been maintained at various points of the Territory, as shown in the following tables.

PUBLICATION AND AVAILABILITY OF INFORMATION.

The daily discharge, with other detailed data pertaining to the streams, ditches, etc., under investigation have been published by the U. S. Geological Survey in the form of annual printed reports which are furnished free to all applicants on request to this office or to the Washington, D. C., office. A shortage of funds and a pressure of work at the Printing Office at Washington, has caused the printing of these reports to be delayed from twelve to twenty-four months after the close of the calendar year. In order that the information collected may reach the public without delay, this division will mail or furnish blue print copies of data pertaining to any stream, ditch, or locality for which information is desired. All original data are also kept on file at Rooms 17 to 22, Kapiolani Building, King and Alakea Streets, and are available for the public at all times.

RECOMMENDATIONS.

It is recommended that the present hydrometric investigations be carried on along the lines as outlined under "Scope of Work," as funds will permit, and that, effective July 1, 1915, the underground water investigation be consolidated with the present hydrographic investigation. It is believed that the two sources of water supply may be more efficiently investigated under one head than under two separate organizations as at the present time.

Attention is invited to the following tabulations showing the financial status and progress of the work.

Very respectfully,

G. K. Larrison,

Superintendent of Hydrography.

FINANCIAL STATEMENT OF DIVISION OF HYDROGRAPHY FOR BIENNIAL PERIOD JANUARY 1, 1913, TO DECEMBER 31, 1914.

Receipts. FEDERAL FUNDS.

Gaging Streams 1912-13 Funds:		
Jan. 1, 1913—Balance allotment placed to credit G. K. Larrison, special disbursing agent	$2,259.75	
Balance of allotment retained at Washington, D.C.	660.51	
Amount placed to credit Hawaii District at Washington, D.C., from funds allotted B-8	19.17	
Gaging Streams 1913-14 Funds:		
Nov. 6, 1913—Allotment placed to credit G. K. Larrison, special disbursing agent	4,500.00	
May 20, 1914—Amount placed to credit G. K. Larrison, special disbursing agent, from funds retained at Washington, D.C.	300.00	
Balance funds retained at Washington, D.C.	200.00	
Gaging Streams 1914-15 Funds:		
Sept. 5, 1914—Allotment placed to credit of G. K. Larrison, special disbursing agent	4,500.00	
Balance retained at Washington, D.C.	500.00	
Total		$12,939.43
Expenditures:		
Jan. 1, 1913 to December 31, 1914.		
By G. K. Larrison, special disbursing agent	$8,857.80	
By Washington office	1,431.81*	10,289.61
Jan. 1, 1915—Bal. credit G. K. Larrison	2,543.50	
Bal. at Washington, D.C.	106.32*	
Total balance	$2,649.82	$2,649.82

(*) Approximate.

LIST OF STREAM GAGING STATIONS MAINTAINED BY DIVISION OF HYDROGRAPHY DURING BIENNIAL PERIOD, JANUARY 1, 1913—DEC. 31, 1914.

ISLAND OF KAUAI.

1. Anahola River above dam near Kealia.
2. *Anahola River at 1,140 ft. elev. near Kealia.
3. *Halekua Stream near Waimea.
4. Hanalei River near Hanalei.
5. Hanalei River at 625 ft. elev. near Hanalei.
6. *Hanamaulu Stream near Lihue.
7. Hanapepe River at Koula near Eleele.
8. Hanapepe River at Falls, each branch, near Eleele.
9. Hanapepe River, above Falls, near Eleele.
10. Hauleia River at stone bridge near Lihue.
11. F* Kaehulua Stream, South Fork at Wainamunamu weir nea. Kapaa.
12. F.* Kaehulua Stream, North Fork at Kainahola weir near Kapaa.
13. Kalihiwai Stream at 700 ft. elev. near Hanalei.
14. *Kalihiwai Stream near Kilauea.
15. Kapaa Stream near Kapaa.
16. F. * Konohiki Stream, mauka weir, near Kapaa.
17. Kauaikanana Stream near Waimea.
18. Kawaikoi Stream near Lihue.
19. *Kawi Stream at 750 ft. elev. near Lihue.
20. *Keahua Stream at 750 ft. elev. near Lihue.
21. F.* Keahuhia Stream at Kuhinoa weir near Kapaa.
22. F. Kilauea River near Kilauea.
23. *Lumahai River near Hanalei.
24. Lumahai River at 700 ft. elev. near Hanalei.
25. Mohihi Stream at lower crossing near Waimea.
26. Makaweli River near Hanalei.
27. *Uhau Iole Stream at 750 ft. elev. near Lihue.
28. Waiakoali Stream near Waimea.
29. Waialae Stream near Waimea.
30. Wailua River, east branch north fork, near Lihue.
31. Wailua River North Fork, near Lihue.
32. Wailua River, south fork above Waiehu Falls, near Lihue.
33. Wailua River, north fork at 650 ft. elev. near Lihue.
34. Waimea River near Waimea.
35. Wainiha River, east channel, near Wainiha.
36. Wainiha River, west channel, near Wainiha.
37. Wainiha River at 850 ft. elev. near Hanalei.
38. Waioli Stream at 800 ft. elev. near Hanalei.

ISLAND OF OAHU.

1. Haiku Stream near Heeia.
2. Hooleinaiwa Stream at Kaneohe, near Heeia.
3. Iolekaa Stream near Heeia.
4. Kahana Stream, east branch, near Hauula.
5. Kahana Stream near Hauula.
6. Kahanaiki Stream, Kailua, near Waimanalo.
7. *Kahanaiki Stream, north fork, Kailua, near Waimanalo.
8. *Kahanaiki Stream, south fork, Kailua, near Waimanalo.
9. Kahawainui Stream, east branch, near Laie.
10. Kailua Stream at Kailua, near Waimanalo.
11. Kaimi Stream at Kailua, near Waimanalo.

12. Kalihi Stream at Kioi Pool, near Honolulu.
13. Kamakalepo Stream at Kailua, near Waimanalo.
14. Kaukonahua Stream, left branch of north fork, near Wahiawa.
15. Kaükonahua Stream, right branch of north fork, near Wahiawa.
16. Kaukonahua Stream, south fork, near Wahiawa.
17. Kaukonahua Stream, south fork, below Army reservoir, near Wahiawa.
18. Kaneohe Stream at Kaneōhe, near Heeia.
19. Kawa Stream at Kaneohe, near Heeia.
20. Koloa Stream near Laie.
21. Kuou Stream at Kaneohe, near Heeia.
22. *Luakaha weir, Nuuanu, near Honolulu.
23. *Lulumaha Stream, Nuuanu, near Honolulu.
24. Luluku Stream at Kaneohe, near Heeia.
25. Malaekahana Stream, middle fork, near Kahuku.
26. Malaekahana Stream, east branch, near Kahuku.
27. Makawao Stream at Kailua near Waimanalo.
28. *Manoa Stream, upper Manoa, near Honolulu.
29. Manoa Stream, west fork, near Honolulu.
30. Manoa Stream, east fork, near Honolulu.
31. Manoa Stream, at College of Hawaii, near Honolulu.
32. Nuuanu Stream below reservoir No. 2, near Honolulu.
33. *Pauoa Stream near Honolulu.
34. Piho Stream at Kaneohe, near Heeia.
35. *Pohakea Stream in Kailua valley, near Waimanalo.
36. *Pukele Stream, Palolo Valley, near Honolulu.
37. Punaluu Stream near Hauula.
38. Waiahole Stream at Manianiaula, near Waikane.
39. Waiahole Stream below power house, near Waikane.
40. *Waiahole Stream above power house, near Waikane.
41. *Waiahole Stream at Waiahole, near Waikane.
42. Wailele Stream near Laie.
43. *Waiomao Stream above Pukele Stream, near Honolulu.
44. Waiomao Stream at 950 ft. elev. in Palolo Valley, near Honolulu.

ISLAND OF MAUI.

1. Alo Stream near Huelo.
2. *Haipuaena Stream near Huelo.
3. Haipuaena Stream near Huelo.
4. Hoolawaliilii Stream near Huelo.
5. Hoolawanui Stream near Huelo.
6. Halehaku Stream near Huelo.
7. Hanawi Stream, near Nahiku.
8. Honokawai Stream near Lahaina.
9. *Honokohau Stream near Honokohau.
10. Honokohau Stream near Honokohau.
11. *Honolua Stream near Honokohau.
12. Honolua Stream near Honokohau.
13. Honomanu Stream near Keanae.
14. Honopou Stream near Huelo.
15. Iao Stream near Wailuku.
16. *Kahakuloa Stream at Kahakuloa, near Wailuku.
17. Kahakuloa Stream at Kahakuloa, ner Wailuku.
18. Kahoma Stream near Lahaina.
19. *Kailua Stream near Huelo.
20. Kailua Stream near Huelo.
21. Kauaula Stream near Lahaina.

22. Kopiliula Stream, west, near Huelo.
23. Lahainaluna Stream, near Lahaina.
24. *Lahainaluna Stream near Lahaina.
25. Launiupoko Stream near Lahaina.
26. *Nailiilihaele Stream near Huelo.
27. Nailiilihaele Stream near Huelo.
28. Oanui Stream near Huelo.
29. Olowalu Stream near Olowalu.
30. Oopuola Stream near Huelo.
31. *Puohakamoa Stream near Huelo.
32. Puohakamoa Stream near Huelo.
33. *Ukumehame Stream near Olowalu.
34. Ukumehame Stream near Olowalu.
35. Waiehu Stream, north, near Wailuku.
36. *Waiehu Stream, south, near Wailuku.
37. Waiehu Stream, south, near Wailuku.
38. Waikamoi Stream near Huelo.
39. Waikapu Stream near Waikapu.
40. Wailuaiki Stream, east, near Keanae.
41. Wailuaiki Stream, west, near Keanae.
42. Wailuanui Stream, east, near Keanae.
43. Wailuanui Stream, west, near Keanae.
44. Waihee Stream at dam near Wailuku.
45. Waihee Stream near Wailuku.
46. Opana Stream, near Huelo.

ISLAND OF HAWAII.

1. *Honolii River near Hilo.
2. F* Kawainui Stream near Pepeekeo.
3. F* Kawainui Stream near Kukuihaele.
4. *Kiilae Stream near Hookena (Special Kona Investigation funds).
5. *Station Nos. 1 to 12, 12a, 13 to 18, 25 to 86, 86a, and 87 at 2,700 ft. level, near Hilo.
6. *Wailuku River near Hilo.
7. F* Waipio River at Waima, near Kukuihaele.
8. F* Waipio River at Koiawe, near Kukuihaele.

LIST OF DITCH GAGING STATIONS MAINTAINED BY DIVISION OF HYDROGRAPHY DURING BIENNIAL PERIOD, JAN. 1, 1913, TO DEC. 31, 1914.

ISLAND OF KAUAI.

1. F* Akulikuli springs at weir, near Kapaa.
2. *Anahola ditch near Kealia.
3. China ditch near Hanalei.
4. Hanamaula ditch near Lihue.
5. F Hanapepe ditch at Koula, near Eleele.
6. F Hanapepe ditch at weir near Makaweli.
7. Hanapepe ditch at falls, near Eleele.
8. Hiloa ditch at falls, near Eleele.
9. Kamenehune ditch, near Waimea.
10. Kanaha ditch near Lihue.
11. F* Kaneha ditch near Kealia.
12. F* Kekaha ditch at Tunnel No. 12, near Kekaha.
13. F* Kekaha ditch at intake, near Kekaha.
14. F* Kapahi ditch near Kealia.
15. *Kuna ditch near Hanalei.
16. Lihue ditch near Lihue.

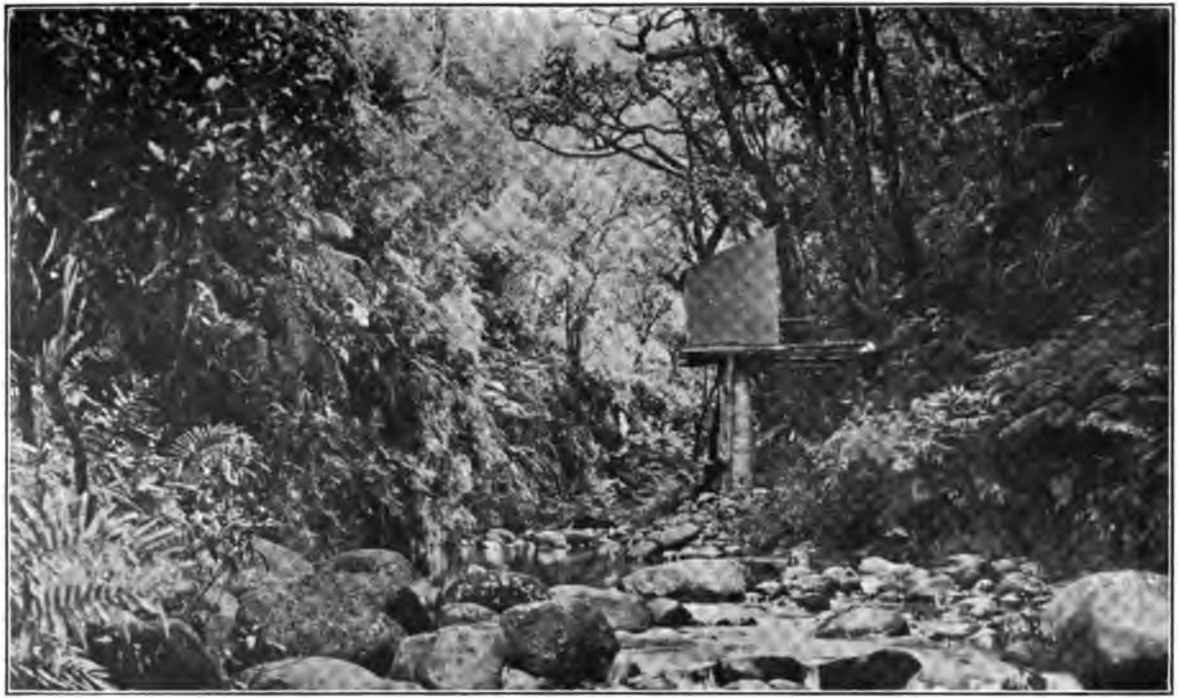


Plate 11 A typical Hawaiian stream during low water. Left branch north fork Kaukonahua Stream at elevation 1250 feet above sea level, Oahu.

17. F Olokele ditch at weir near Waimea.
18. F Olokele ditch at tunnel No. 12 near Makaweli.
19. *Poowaiomahaihai ditch near Waimea.
20. *Waimea ditch near Waimea.
21. F Wainiha canal at intake, near Wainiha.

ISLAND OF OAHU.

1. Ahlo ditch at Kaneohe, near Heeia.
2. Hop Tuck Wai ditch, near Heeia.
3. *Kahanaiki ditch, mauka, at Kailua, Waimanalo.
4. *Kahanaiki ditch, makai, at Kailua, Waimanalo.
5. *Kahuawai spring, near Honolulu.
6. Kuou ditch at Kaneohe, near Heeia.
7. Lee Wai ditch, near Heeia.
8. *Lulumaha ditch, Nuuanu, near Honolulu.
9. Luluku ditch, south, at Kaneohe, near Heeia.
10. Luluku ditch, north, at Kaneohe, near Heeia.
11. Makawao ditch near Waimanalo.
12. F Makawao spring at Maunawili ranch, near Waimanalo.
13. F Main spring at Kailua, near Waimanalo.
14. *Pump ditch, near Waimanalo.
15. Reservoir ditch, near Heeia.
16. Reservoir feed canal, Army reservoir, near Wahiawa.
17. *Waimanalo ditch, near Waimanalo.
18. Waipio ditch, near Heeia.
19. Wing Wo Tai ditch, near Heeia.
20. Wong Leong ditch, near Heeia.
21. Young Mau ditch at Kaneohe, near Heeia.

ISLAND OF MAUI.

1. *Center ditch near Huelo.
2. Honokawai ditch near Lahaina.
3. *Honolua ditch near Honokohau.
4. *Honokohau ditch near Honokohau.
5. Kahoma weir near Lahaina.
6. F* Koolau ditch near Keanae.
7. Kauaula ditch near Lahaina.
8. *Lahainaluna ditch near Lahaina.
9. *Manienia ditch near Wailuku.
10. Olowalu ditch No. 1 near Olowalu.
11. Palolo ditch near Waikapu.
12. Waiehu ditch, south, near Wailuku.
13. Waikapu ditch, south side, near Waikapu.
14. *New Hamakua ditch at gage No. 1, near Huelo.
15. * " " No. 2, "
16. * " " No. 3, "
17. * " " No. 4, "
18. * " " No. 5, "
19. *Spreckels ditch near Waihee.
20. *Spreckels ditch at gage No. 1, near Huelo.
21. * " " No. 2, "
22. * " " No. 3, "
23. * " " No. 4, "
24. * " " No. 5, "
25. * " " No. 6, "
26. * " " No. 7, "
27. * " " No. 8, "
28. *Waihee canal near Waihee.

ISLAND OF HAWAII.

1. F* New Hamakua ditch at flume, near Waima.
2. F* New Hamakua ditch at main weir, near Kukuihaele.
3. F* Hamakua ditch at main weir, Puaalala.
4. F* Kohala ditch, near Kohala.
5. F* Kehena ditch, near Kohala.

Note—(*) Discontinued.
(F) Records furnished by private parties.
(F*) Furnished records now discontinued.

LIST OF RAINFALL GAGING STATIONS MAINTAINED BY DIVISION OF HYDROGRAPHY, BIENNIAL PERIOD, JAN. 1, 1913, TO DECEMBER 31, 1914.

ISLAND OF KAUAI.

1. Aakukui at 350 ft. elevation.
2. Camp No. 7, Waimea, at 150 ft. elev.
3. Camp No. 2, Hanapepe, at 250 ft. elev.
4. *Hanahanapuni at 911 feet elev.
5. Hanalei at 625 ft. elev.
6. Hanapepe at 510 feet elev.
7. Hiloa-Hanapepe divide at 2,080 feet elev.
8. Hukipo at 400 ft. elev.
9. Kahana at 3,750 ft. elev.
10. Kaholuamanu at 2,600 ft. elev.
11. Kalihiwai River at 750 ft. elev.
12. Keanakua at 4,450 ft. elev.
13. Kekaha ditch intake at 525 ft. elev.
14. Kilohana at 4,023 feet elev.
15. Kohua Ridge at 3,950 ft. elev.
16. Kokee at 3,550 ft. elev.
17. Lehuamakanoi at 3,932 ft. elev.
18. Lumahai River station at 700 ft. elev.
19. Mohihi crossing at 3,500 ft. elev.
20. Mohihi-Koaie divide at 3,950 ft. elev.
21. Paukahana at 3,723 ft. elev.
22. Pali trail at 850 ft. elev. near Waimea.
23. Pohakupili at 2,590 ft. elev.
24. Puu Lua at 3,500 ft. elev.
25. Puu Eu at 2,747 ft. elev.
26. Olokele ditch mauka, at 2,100 ft. elev.
27. Sanborn's residence at 105 ft. elev.
28. Waiahi at 600 ft. elev.
29. Waiakoali camp at 3,450 ft. elev.
30. Waialae at 3,600 ft. elev.
31. *Waialeale Mt. at 5,080 ft. elev.
32. North Wailua at 1,200 ft. elev.
33. Wainiha Intake at 700 ft. elev.
34. Wainiha power house at 123 ft. elev.
35. Wainiha-Kapaka at 635 ft. elev.
36. Wainiha ridge at 1,900 ft. elev.
37. Newlun station at 460 ft. elev.
38. North Wailua at 650 ft. elev., Lihue.
39. North Wailua at 550 ft. elev., Kanaha.

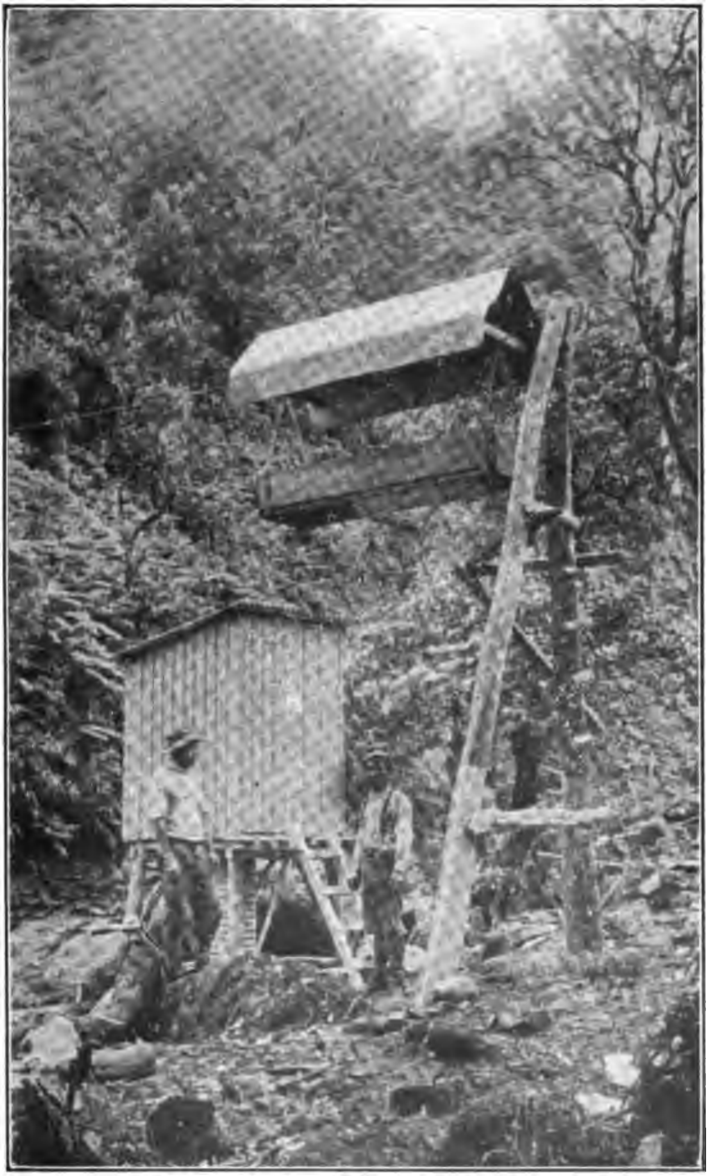


Plate 12. Standard gaging car used in making high water measurements from cable, and standard house for sheltering automatic register. Wainiha Stream at 850 ft. elev. above sea level, Kauai.

ISLAND OF OAHU.

1. *Kaau-Palolo Crater at 1,700 ft. elev.
2. Kalihi valley at 520 ft. elev.
3. *Kaimuki at 4th Ave., near Honolulu.
4. *Konahuanui at 3,100 ft. elev.
5. Makaha gulch at 1,300 ft. elev.
6. Manoa at Shingle's residence, 320 ft. elev.
7. North fork Kaukonahua at 1,200 ft. elev.
8. *Olympus at 2,450 ft. elev.
9. Pali at 1,200 ft. elev.
10. Waiahole-Waiawa at 2,150 ft. elev.
11. Wahiawa at 940 ft. elev.
12. Wahiawa intake at 1,200 ft. elev.
13. Waiahole tunnel at north portal, 775 ft. elev.
14. *Waiomao at 600 ft. elev.
15. *Luakaha at 1,150 ft. elev.

ISLAND OF MAUI.

1. Anahola at 4,100 ft. elev.
2. F Camp No. 7, H. C. and S. Co.,
3. Eke Mt., at 4,500 ft. elev.
4. Honokohau Camp on ridge at 2,300 ft. elev.
5. F Honokohau ditch intake at 800 ft. elev.
6. F Honokowai at 1,500 ft. elev.
7. F Honokahua at 760 ft. elev.
8. F Honomanu at 1800 ft. elev.
9. *Iao Cave at 1,720 ft. elev.
10. Iao tableland at 1,500 ft. elev.
11. Iao Stream at 830 ft. elev.
12. F Keanae at 1,000 ft. elev.
13. F Kopiliula at 1,220 ft. elev.
14. F Kihei at about 25 ft. elev.
15. F Old Plantation office at Waihee.
16. F Olowalu at 10 ft. elev.
17. Olowalu gulch at 700 ft. elev.
18. F* Olinda at 4000 ft. elev.
19. F Penhallow's residence at 390 ft. elev.
20. F Puohakamoa at 4,300 ft. elev.
21. Puu Kukui at 2,500 ft. elev.
22. Puu Kukui at 5,000 ft. elev.
23. F Puunene at 50 ft. elev.
24. F Spreckelsville (Camp No. 1) at 50 ft. elev.
25. Waihee tunnels at 1500 ft. elev.
26. F Waikamoi at 4,200 ft. elev.
27. F Waikamoi at 1,250 ft. elev.
28. Waikapu gulch at 1,535 ft. elev.
29. F Wailuku Sugar Co. office at 175 ft. elev.
30. F Waiehu at 200 ft. elev.

ISLAND OF HAWAII.

1. F* Ahualoa homesteads at 2,550 feet elev.
2. F Alakahi-Waipio at 1,030 ft. elev.
3. F Alakahi-Waipio at 3,870 ft. elev.
4. F,* Camp No. 8, Waiakea, at 1500 ft. elev.

5. F_1* Camp No. 6, Waiakea, at 800 ft. elev.
6. F_1* Civil Engineers office at 1,120 ft. elev.
7. F_1* Hilo Breakwater at 15 ft. elev.
8. F_1 Honokane mauka at 3,800 ft. elev.
9. F Hope-a, makai, at 4,000 ft. elev.
10. F Hope-a, mauka, at 5,000 ft. elev.
11. F_1 Kaauhuhu at 1,400 ft. elev.
12. F_1 Kemole house, near east base of Mauna Kea.
13. F_1 Kohala Mt. pipe line.
14. F_1 Umikoa-Kukaiau at 3,400 ft. elev.
15. F_1 Kaala tanks at 5,500 ft. elev.
16. Lower Kawainui at 1,040 ft. elev. (F).
17. F Upper Kawainui at 4,080 ft. elev.
18. F Lower Koiawe at 1,000 ft. elev.
19. F_1 Upper Koiawe at 3,350 ft. elev.
20. F_1 Kohala pipe line near Waimea.
21. F_1* Piihonua near Hilo at 950 ft. elev.
22. F_1 Pohakuloa near Humuula.
23. F_1 Puuhinei Paddock near Huuhinei hill.
24. F_1 Puuanuanu Paddock, west base, Mauna Kea.
25. F_1 Punohu Paadock, east side.
26. F_1 Puu Kihe at 7,822 ft. elev.
27. F_1 Puu Kea at 8,565 ft. elev.
28. F_1 Puahala at 6,500 ft. elev.
29. F_1* Reservoir No. 13 at 1,480 ft. near Honokaa.
30. *Station No. 1, Wainaku Camp, at 200 ft. elev.
31. *Station No. 2, Wainaku camp, at 1,000 ft. elev.
32. *Station No. 3, Kaiwiki, at 1,500 ft. elev.
33. * " No. 4, " 2,000 "
34. * " No. 5, " 2,650 "
35. * " No. 6, " 3,000 "
36. * " No. 7, " 3,500 "
37. * " No. 8, " 4,000 "
38. * " No. 9, " 4,500 "
39. * " No. 10 " 5,000 "
40. F Waima at 980 ft. elev.
41. *Waianuenue Street, Hilo.

KONA, ISLAND OF HAWAII.

1. Hokukano at 2,990 ft. elev.
2. *Honalo at 2,740 ft. elev.
3. *Honuaino-Waiho at 2,550 ft. elev.
4. *Honuaula at 3,120 ft. elev.
5. *Honuaula at 1,880 ft. elev.
6. Honaunau at 2,540 ft. elev.
7. Kahaluu at 2,460 ft. elev.
8. Kealakekua at 3,000 ft. elev.
9. *Kealakekua at 3,560 ft. elev.
10. *Kealia at 6,000 ft. elev.
11. Keauhou at 2,610 ft. elev.
12. Kiilae at 2,740 ft. elev.
13. *Lehuula at 3,840 ft. elev.
14. *Noluaio at 2,760 ft. elev.
15. *Puaa at 3,720 ft. elev.

Note—(*) Station discontinued.
(F) Records furnished by private parties, private gage.
(F_1) Records furnished by private gages; U. S. Geological Survey gage.

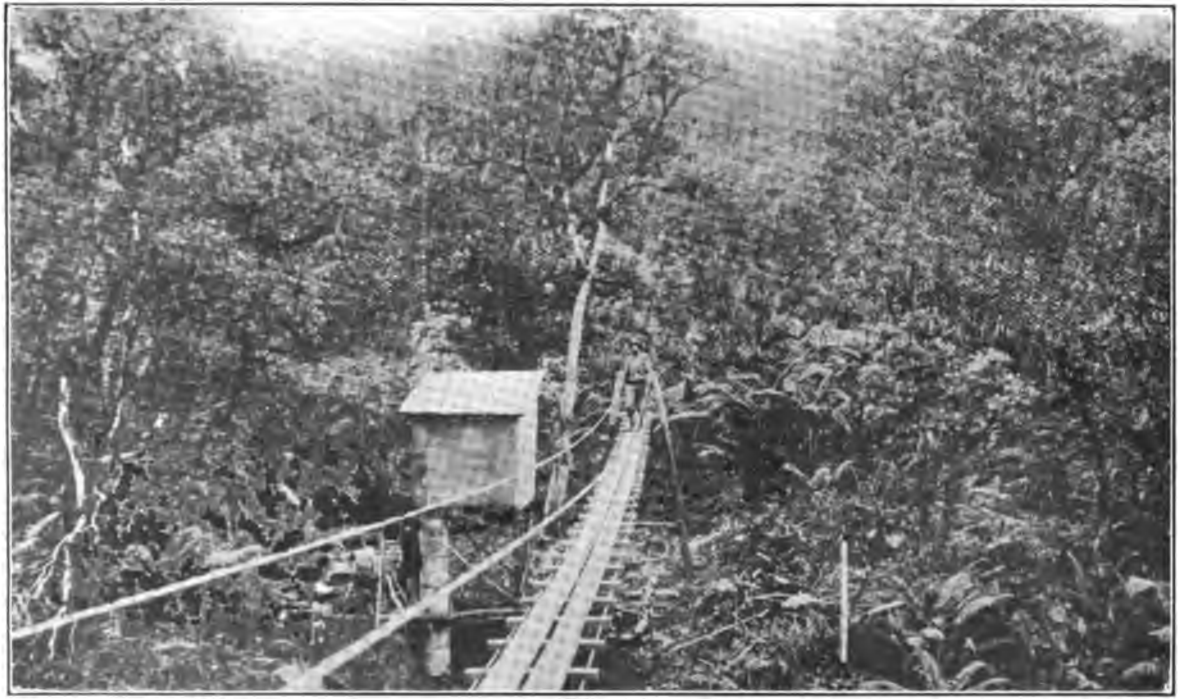


Plate 13. A typical suspension bridge from which high water measurements are made. Hanalei Stream at elevation 700 ft. Kauai. The equipment and materials for this station were packed over seven miles on men's backs.

COOPERATIVE STREAM AND DITCH MEASUREMENT STATIONS.

January 1, 1913, to December 31, 1914.

Island	Stream	Cooperating Party	Type of Station
Kaaui.			
1.	Anahola	Makee Sugar Co.	**Friez register
2.	*Anahola ditch	Makee Sugar Co.	**Watson register
3.	*Halekua	Haw'n. Sugar Co.	B. & L. register
4.	Hanapepe ditch, Koula	Haw'n. Sugar Co.	Staff.
5.	Huleia	Chas. Rice.	Staff.
6.	*Kalihiwai	Princeville Plant'n.	Staff.
7.	*Kanaha ditch	Makee Sugar Co.	Staff.
8.	*Kapahi ditch	Makee Sugar Co.	**Watson register
9	*Kaneha ditch	Makee Sugar Co.	**Watson register
10.	*Kekaha ditch intake	Kekaha Sugar Co.	Staff.
11.	*Kekaha ditch tunnel	Kekaha Sugar Co.	Staff.
12.	Kilauea	Kilauea Sugar Co.	Staff.
13.	Wainiha, E. channel	Kauai Elec. Co.	Staff.
14.	Wainiha, W. channel	Kauai Elec. Co.	Staff.
15.	Wainiha canal	Kauai Elec. Co.	Staff.
Oahu.			
1.	Kahawainui, E. Br.	Kahuku Plant. Co.	Stevens register.
2.	Kaukonahua, Lt. Br. N. Fk.	Wahiawa Water Co.	Stevens register.
3.	Kaukonahua, Rt. Br. N. Fk.	Wahiawa Water Co.	Stevens register.
4.	Kaukonahua, S. Fk.	U. S. Army	Stevens register.
5.	Kaukonahua, S. Fk., makai	U. S. Army	Stevens register.
6.	Koloa	Laie Plantation	Stevens register.
7.	Main Springs	Maunawili Ranch	Staff.
8.	Makawao ditch	Maunawili Ranch	**Watson register.
9.	Makawao spring	Maunawili Ranch	Staff.
10.	Malaekahana, Md. Fk.	Kahuku Plant. Co.	Stevens register.
11.	Malaekahana, E. Br.	Kahuku Plant. Co.	Stevens register.
12.	Reservoir feed canal	U. S. Army	Watson register.
13.	Wailele	Laie Plantation	Stevens register.
Maui.			
1.	Honokawai ditch	Pioneer Mill Co.	Staff.
2.	Honokohau	Honolua Ranch	**Stevens register.
3.	Kahakuloa	Honolua Ranch	**Stevens register.
4.	Kahoma	Pioneer Mill Co.	Staff.
5.	Kahoma weir.	Pioneer Mill Co.	Staff.
6.	Kauaula ditch	Pioneer Mill Co.	Staff.
7.	Kauaula	Pioneer Mill Co.	Staff.
8.	Lahainaluna	Pioneer Mill Co.	Staff.
9.	*Lahainaluna ditch	Pioneer Mill Co.	Staff.
10.	Launiupoko	Pioneer Mill Co.	Staff.
11.	N. Waiehu	Wailuku Sugar Co.	Staff.
12.	Olowalu	Olowalu Plantation	Staff.
13.	Olowalu ditch	Olowalu Plantation	Staff.
14.	Ukumehame	Olowalu Plantation	Staff.
Hawaii.			
1.	Kawainui	Haw'n. Irrigat. Co.	Staff.
2.	Waipio R. at Koiawe	Haw'n. Irrigat. Co.	Staff.
3.	Waipio R. at Waima	Haw'n. Irrigat. Co.	Staff.

Note—(*) Discontinued. (**) Register owned by Div. of Hydrography. On Oahu, the Heeia Agricultural Co. and the Kaneohe Ranch Co. are paying one-half the gage readers salaries on 24 small stream and ditch measurement stations in the Kailua, Kaneohe and Heeia valleys.

SUMMARY.

No. of Regular Gaging Stations.							Measurements.	
Island.	Maintained on Jan. 1, 1913	Established during period	Discontinued during period.	Maintained on Dec. 31, 1914	Total number of regular stations maintained during biennial period.	Total number of private station records furnished during biennial period	At regular stations.	At miscellaneous points.
Stream and Ditch Measurement Stations.								
Kauai	52	7	22	37	59	16*	197	12
Oahu	23	42	18	47	65	2*	303	146
Maui	56	18	32	42	74	1*	368	48
Hawaii	89	0	89	0	89	4*-5	169	112
Kona, Hawaii	0	1	1	0	1	0	0	0
Total....	220	68	162	126	288	23*-5	1,037	318
Rainfall Measurement Stations.							Total number of Stations for which records are available.	
Kauai	27	13	6	34	40	6	46	
Oahu	9	6	6	9	15	0	15	
Maui	14	2	5†-3	8	16	5*-14	30	
Hawaii	18	10‡	13	15†	28	12	40	
Kona, Hawaii	0	15	9	6†	15	0	15	
Total	68	46	42	72	114	5*-32	146	

Note—* Counted twice. † Records now sent in by private parties.
‡Gages furnished to private parties by office.

Division of Entomology

Report of the Superintendent of Entomology

Honolulu, Hawaii, December 31, 1914.

The Board of Commissioners of Agriculture and Forestry,
Honolulu, Hawaii.

Gentlemen:

I have the honor to submit herewith the biennial report of the Division of Entomology covering the work of this Division from January 1, 1913, to December 31, 1914.

The most important work of the Division of Entomology during this biennial period consisted in the inspection of all agricultural and horticultural products imported into the Territory from the mainland and foreign countries. In conjunction with this work the Territorial and Interisland inspection of all fruits, vegetables and plants was maintained, and justly so, as Honolulu, being the official port of entry for the Islands, is placed in such a position, that accidentally introduced pests can for a long period, at least, be prevented from spreading to the other Islands by a thoroughly equipped inspection force. There was also attached to this general work the search, introduction, breeding and distribution of parasites of the fruit fly and horn fly and other beneficial insects for the control of these and other pests. This work, although attached to the Division, was under the direct supervision of Mr. W. M. Giffard, President and Executive Officer of the Board of Agriculture and Forestry. This special line of work was reported on in Bulletin No. 3 of this Division, entitled "Report of an Expedition to Africa in Search of the Natural Enemies of Fruit Flies," by Prof. F. Silvestri, which report was issued on February 11, 1914, and included an account of the search, discovery, introduction, breeding and distribution of parasites on the Mediterranean and other fruit flies up to and including December 31, 1913. From January 1, 1914, until June 1st of the same year the breeding and distribution of parasites was carried on by Mr. J. C. Bridwell, the main object during this latter period being to keep alive all those species brought by Prof. Silvestri from Africa, as well as two species of horn fly parasites brought by Mr. D. T. Fullaway from the Philippines. On June 1, after ascertaining that Prof. Silvestri was unable to secure a further leave of absence from the Italian government to make a further search for parasites in West Africa, especially the ones he failed to introduce alive on his first expedition, arrangements were made with Mr. Fullaway of the Hawaii Experiment Station to undertake the expedition under the auspices and direction of the Board of Agriculture and Forestry, Mr. Bridwell being delegated to accompany him as his assistant. During the absence of these two gentlemen the writer took direct supervision of the parasite breeding in the insectary so as to keep alive all species on hand until Mr. Fullaway's return, which was on October 27, 1914. A full account of the second expedition, including breeding, recovery and distribution on the several Island by districts of all the various parasites collected during the biennial period, is attached hereto as a special report by Mr. Fullaway, who has had charge of this work since his return from Africa. The account of the first expedition by Prof. Silvestri will be found in Bulletin No. 3 of this Division, as previously stated. By a special arrangement made between the President of the Board of Agriculture and Forestry and Dr. E. A. Back, special agent of the U. S. Bureau of Entomology, I am also able to append hereto a report by him and Mr. C. E. Pemberton, his assistant, giving the percentage of parasitism and other observations obtained while carrying on other investigations for the U. S. Government from materials collected in the field.

There have been the usual inquiries regarding pests attacking plants and it has been possible in a small measure for the Superintendent to give advice for the control of some of these whenever a request came to hand. He has also been able to visit a few localities and examine into damage done to crops by certain pests. Appended hereto is a report on those insects which have more or less given trouble during this period and such remedies which have been successfully used in their abatement.

STAFF.

Your Superintendent has continued as head of the Division during this biennial period, having as assistant inspector Mr. D. B. Kuhns, and as assistants on the wharves Messrs. Edward Drew, Robert W. Kanakanui and Isaac Kahere. On June 3, 1913, Mr. J. C. Bridwell was appointed assistant superintendent of entomology. On account of the unexpected arrival of Prof F. Silvestri with parasites from Africa, and finding it difficult to obtain a qualified man for parasite work here, as previously stated he was detailed for that work by direction of the Executive Officer. The services of Mr. D. T. Fullaway, entomologist of the Hawaii Experiment Station, were upon request also loaned to the Board for similar work, and the latter remained in charge of it until

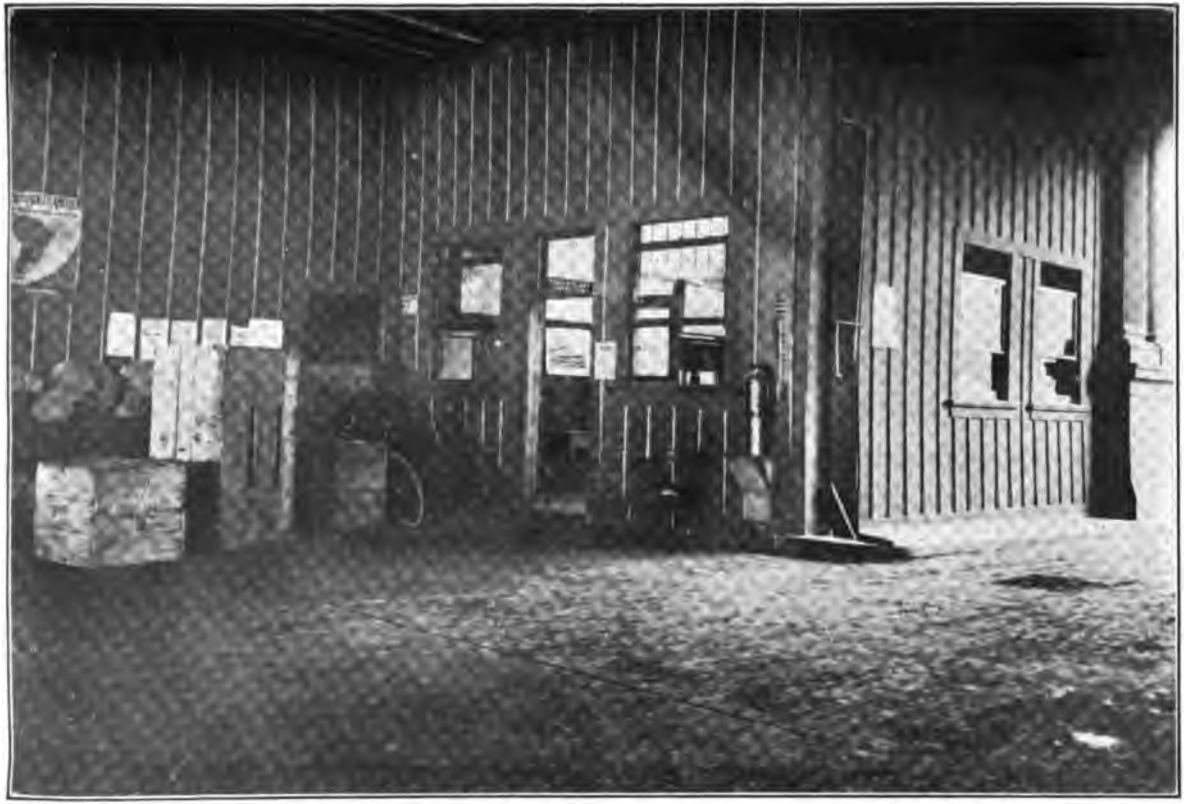


Plate 14. **New Plant Inspector's Office on Pier No. 7, Honolulu, with shipment of plants in foreground awaiting inspection.**

October, 1913, at which time he was sent to the Philippines on research work by the U. S. Government.

Miss Agnes Buchanan was appointed as assistant in the parasite laboratory as well as Mr. Rodrigo Villaflor, their particular work being under Mr. Fullaway and Mr. Bridwell. On January 1, 1914, the work of distribution of parasites was curtailed and on my recommendation Miss Buchanan was appointed laboratory assistant under me, principally to care for the valuable collection of insects and to prepare, mount and label all insects collected, donated and taken in quarantine, also to assist in other important work when called upon. Brother Matthias Newell has continued as our regular inspector at the Port of Hilo, Hawaii, and the following gentlemen have served as honorary inspectors at the various ports on the other Islands:

Mr. E. E. Madden, Mahukona, Hawaii; Mr. E. R. Bevin, Kahului, Maui; Dr. W. D. Deas, Hana, Maui; Capt. C. F. Turne, Kaanapali, Maui; Mr. W. D. McBryde, Koloa, Kauai; Mr. G. C. Munro, Keomoku, Lanai.

WORK PERFORMED.

During 1913 and 1914 a decided increase in the arrival of horticultural products as well as a material increase in the number of vessels entering the Territory has been noted, especially since the opening of the Panama Canal. The inspection of fruit, plants, vegetables, also of rice, beans and other cereals arriving as freight, express packages, through the U. S. mail, and in the baggage of the travelling public has kept the force very busy.

During the biennial period the superintendent and his assistnats including the Port of Hilo, boarded and inspected 1113 vessels and found 681 of these carrying vegetable matter consisting of 628,725 packages. Of this amount 606,222 packages consisted of fruits and vegetables imported from the mainland as food for home consumption; 8090 packages were seeds and 14,413 packages were plants. From these shipments on account of infestation by insect pests or plant diseases, 1,777 packages were destroyed by burning, 14,521 packages were fumigated before delivery, and 776 packages were returned to the shipper.

RICE AND BEAN SHIPMENTS.

The enormous consumption of rice and beans by the Oriental population of these Islands has created a great movement in these commodities from the Orient into the Territory, which apparently is increasing annually. All shipments of rice and beans are constantly watched and are carefully inspected not only for the rice weevil (*Calandra orysae*), which species already exists on the Islands, but more especially for the rice moth (*Paralipsa mo-*

desta), a very serious pest of stored rice and beans not as yet introduced. All rice shipments destined here are fumigated at Kobe, Japan, under Rule III. of the Board of Agriculture and Forestry, and I am pleased to say that of the total shipments of 602,375 bags of rice and 50,535 bags of beans inspected we only found 3,400 bags of rice and 162 bags of beans which had to be fumigated on account of infestation by the rice moth.

The rice moth (*Paralipsa modesta*) attacking bean shipments came to our notice during 1913, and I immediately requested all shippers to include beans in the fumigation order at Kobe, Japan. In this matter I had the heartiest cooperation of the consignees and of the Japanese Merchants' Association, and herewith extend to them my sincere appreciation.

About the middle of November, 1913, the Toyo Kisen Kaisha Steamship Company made Hilo a direct port of call for their South American run instead of Honolulu. This meant that Hilo would be a direct port of entry for Japanese goods, and the arrival of all kinds of freight including rice and beans. During 1913 and 1914 a number of steamers touched at Hilo and large cargoes of rice and beans were landed, but fortunately all these shipments were free from the rice pests. Precautions were taken with the first shipment lest some misunderstanding regarding the fumigation requirements had been made, and I dispatched Mr. D. B. Kuhns to Hilo to be present at the landing of the shipment. He found that the rice was clean, and that the shippers had attended to the fumigation at Kobe; the first steamer brought 6457 bags of rice and 110 bags of beans.

EQUIPMENT.

It is very gratifying to me to be able to report that our inspection equipment is at least very complete at the Port of Honolulu. In 1912 I drew attention to the inadequate quarters that were at our disposal for fumigating large shipments of rice (see page 120 of the 1912 report), and recommended the erection of a large house for fumigating purposes at that time. During the latter part of 1913 a very substantial building 20 x 30 feet with 12 foot ceiling has been built on Kilauea Street near Pier No. 7, it being the most important dock where Oriental cargoes are landed. In building this structure the very best plans for economy as well as efficiency were used. Every precaution has been used to make fumigation without danger to human life, and two ventilators, one to expel heavy gases and the other to expel light gases, have been installed. We have had occasion to use the house, and have had excellent results. Through the kindness of the Board of Harbor Commissioners, the old office under the staircase has been changed to a large roomy office at the entrance of Pier No.

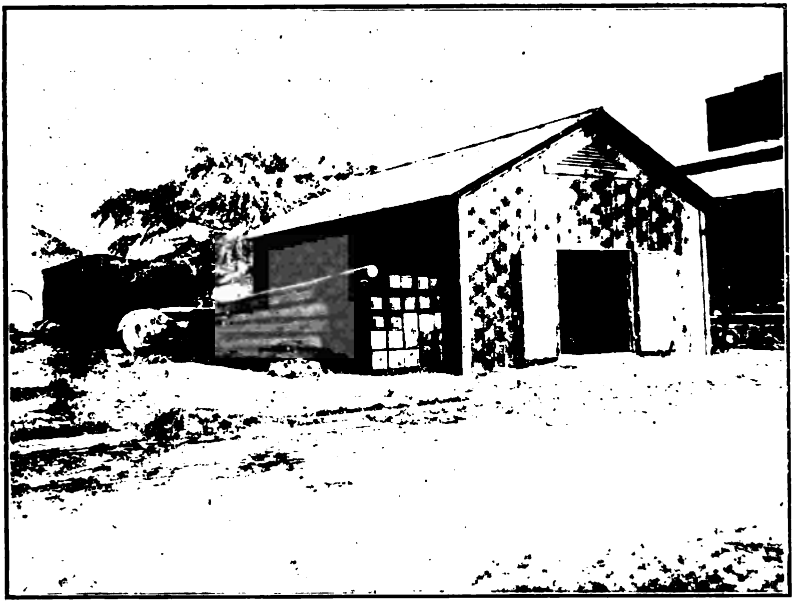


Plate 15. Fig. 1. Plant fumigating house, Kilauea Street, Honolulu.

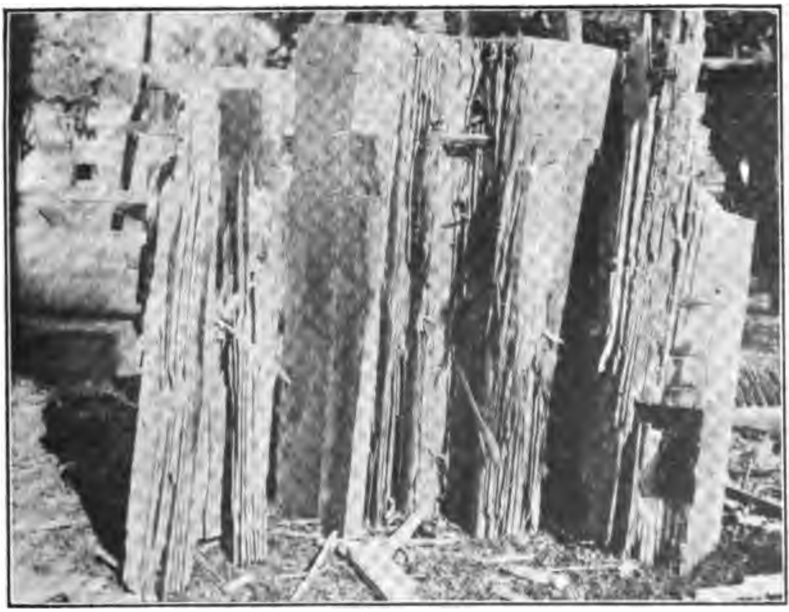


Plate 15. Fig. 2. Timbers destroyed by Termites or White Ants in Honolulu.

7. The office is more commodious, has a cement floor, and has greatly assisted us in our important work. I take this opportunity in again thanking the Board of Harbor Commissioners for their cooperation and many past favors. As the Port of Hilo is now in direct communication with the Orient we are somewhat handicapped in regard to a suitable fumigating room. The small room on the Matson Whraf is sufficient for ordinary work, but would not answer in case a large shipment of rice had to be treated. This matter was taken up during the last year, but as the Kuhio wharf was without covering it was thought best to postpone the erection of suitable quarters at present. However, that we might be prepared to handle an infested shipment, should such arrive, I had two large gas-proof tarpaulins made, which can be used for the purpose until such time when a better equipment can be installed. The question is often asked why rice shipments are found infested after being fumigated at Kobe, Japan. In reply to this I will state that these shipments can become infested from non-fumigated rice on board the steamers, because the rice shipments going to the coast from Japan are not fumigated, and very often the cargo destined for Honolulu is placed alongside or on top of these shipments. The larvae of the rice moth and rice weevils can readily crawl from one lot to another. The consignees at Honolulu or Hilo therefore can hardly be held responsible for infestations, especially if they have complied with the regulations of the Board. All bills of lading of rice shipments have the government certificate of fumigation attached. I have taken up the matter of fumigation for coast shipments with the California Commissioners of Horticulture, but so far no action has been taken.

INTER ISLAND INSPECTION.

During the biennial period the inspection of inter island shipments of fruits, vegetables and plants has been continued despite the fact that the Mediterranean fruit fly, for which this work was originally started, has found its way to all the islands. Now that this pest has gained a foothold on all the islands, we are more than ever convinced that other pests, which might be accidentally introduced at Honolulu, the port of entry, should be closely watched. Besides fruit, vegetables and plants especial stress has been put on inspection of soil attached to the roots of plants which were removed from the ground or recently potted. The constant finding of grubs and beetles and other noxious insects in soil from the Orient and other countries, demonstrates clearly the necessity of a very close inspection here. It is also well known that many fungi and diseases of plants are carried in soil and having a system for inter-island inspection, it will be a very easy matter to so formulate regulatios to prohibit absolutely the shipment of materials which would tend to carry any pest or disease, should such be accidentally introduced.

During the biennial period 1438 steamers going from Honolulu to various ports on the other islands were attended to, and 23,906 packages were examined. These consisted of 5,136 packages of plants, 18,116 packages of vegetables and 654 packages of fruit. The bulk of the plants were nursery stock shipped by the Division of Forestry in the usual plant boxes, being young seedlings grown in sterilized soil. The bulk of the vegetables was taro for poi making, and this is always thoroughly cleansed from soil before shipment. The fruit was mostly imported fruit from the mainland. In all 668 packages were refused shipment because of infestation, or, in the case of plants, because questionable soil was attached to the roots. On account of the rush of passengers at the gangways at time of sailing it has been our practice to inspect the staterooms, and especially look through the steerage quarters before the gangway is lowered. As far as finances and equipment would permit, everything has been done to make the inter-island inspection thorough.

The following tables give a summary of the inspection work performed at Honolulu and Hilo, also one table showing a summary of inter-island inspection:

MONTHLY INSPECTION AT HONOLULU, 1913

Month	Vessels Inspected	Vessels carrying Fruits and Vegetables	PASSED		FUMIGATED		BURNED		RETURNED					TOTAL INSPECTED	
			Lots	Parcels	Lots	Parcels	Lots	Parcels	Lots	Parcels	Seeds	Plants	Fruits and Vegetables	Lots	Parcels
Jan.	43	27	863	23,959	13	219	67	104	..	..	99	370	23,813	942	24,282
Feb.	32	21	563	20,853	5	9	35	46	..	..	117	60	20,731	603	20,908
Mar.	39	25	878	22,221	15	329	69	87	..	..	197	469	21,971	962	22,637
April	38	25	693	15,492	6	43	33	52	2	11	146	131	15,321	734	15,598
May	40	24	677	13,322	9	424	48	65	1	1	113	450	13,149	735	13,712
June	40	21	1,129	16,929	11	32	65	74	1	1	556	107	16,373	1,206	17,036
July	43	22	1,035	18,392	17	575	43	135	2	61	56	523	18,584	1,087	19,163
Aug.	43	23	910	21,827	4	13	34	43	..	..	45	52	21,786	948	21,883
Sept.	34	22	1,200	26,948	1	1	39	45	5	82	133	81	26,862	1,245	27,076
Oct.	43	25	884	24,782	3	255	49	108	2	26	152	408	24,611	938	25,171
Nov.	37	25	892	24,739	11	36	63	75	..	..	124	250	24,476	966	24,850
Dec.	34	22	1,201	26,805	15	1,914	68	77	1	1	128	2,482	26,187	1,285	28,797
Total	466	282	10,925	256,169	110	3,850	613	911	14	183	1,866	5,383	253,864	11,652	261,113

MONTHLY INSPECTION AT HONOLULU, 1914.

Month	Vessels Inspected	Vessels carrying Fruits and Vegetables	PASSED		FUMIGATED		BURNED		RETURNED		Seeds	Plants	Fruits and Vegetables	TOTAL INSPECTED		Rice	Beans
			Lots	Parcels	Lots	Parcels	Lots	Parcels	Lots	Parcels				Lots	Parcels		
Jan.........	39	27	963	22,998	14	1,144	102	128	2	2	160	1,244	22,888	1,081	24,272	33,940	4,089
Feb.........	34	24	683	15,276	1	27	41	43	4	42	127	196	15,025	729	15,388	18,005	1,721
March......	39	29	1,227	22,911	2	3	86	91	7	166	295	142	23,724	1,322	24,171	17,872	2,366
April.......	36	26	648	17,712	33	7,771	62	91	8	21	4,145	3,877	17,553	751	25,595	32,576	2,357
May........	37	25	840	14,188	4	64	22	23	1	1	206	126	13,964	867	14,276	10,567	1,098
June........	35	24	1,309	20,071	1	1	47	48	1	1	126	79	19,956	1,358	20,121	34,981	3,521
July........	37	20	1,016	20,590	13	36	33	33	4	4	157	66	20,460	1,066	20,663	22,569	2,434
Aug.........	37	18	1,099	23,100	2	101	30	52	1	1	172	59	23,033	1,132	23,254	31,397	2,179
Sept........	32	18	1,444	37,157	1	6	12	27	1	1	183	142	36,856	1,458	37,191	18,044	1,786
Oct.........	36	18	1,145	30,441	1	2	27	27	1	1	166	41	30,274	1,174	30,471	40,674	2,112
Nov........	39	22	1,208	30,740	9	123	39	39	4	4	179	1,468	29,269	1,260	30,906	41,778	6,883
Dec........	42	21	1,311	29,851	9	1,393	49	114	6	138	308	1,590	29,578	1,375	31,496	8,287	3,152
Total	443	272	12,893	286,035	90	10,671	550	716	40	382	6,224	9,030	282,570	13,573	297,804	310,690	33,698

MONTHLY INSPECTION AT HILO, 1913.

Month	Vessels Inspected	Vessels carrying Vegetable Matter	Passed	Burned	Returned	Lots	Total Inspected	Remarks
Jan.........	6	5	3,249	..	..	157	3,249	500 T. Sand
Feb.........	10	6	2,037	..	..	97	2,037	
March......	6	4	2,783	..	..	127	2,783	6 T. Sand.
April........	6	5	1,168	..	..	67	1,168	
May.........	10	5	2,381	..	..	115	2,381	One vessel had
June........	9	5	1,866	..	..	107	1,866	ballast thrown
July.........	8	6	2,082	..	..	119	2,082	into sea.
Aug........	8	6	3,353	10	..	214	3,363	
Sept........	10	5	3,388	..	..	207	3,388	
Oct.........	8	4	4,010	..	..	237	4,010	
Nov........	11	5	3,984	..	188	251	4,172	6457 bags rice.
Dec.........	7	4	4,315	1	..	226	4,316	110 bags beans.
Total	99	60	34,616	11	188	1,924	34,815	6,457 pkgs. rice.

MONTHLY INSPECTION AT HILO, 1914.

Month	Vessels Inspected	Vessels carrying Vegetable Matter	Passed	Burned	Returned	Lots	Total Inspected	Notice	Rice Packages	Beans
Jan.........	7	5	2,191	100	3	122	2,294	..	630	588
Feb.........	7	7	1,923	39	..	91	1,962	..	....	...
March......	9	6	1,924	..	..	107	1,924	..	6,100	420
April........	11	6	2,408	..	..	132	2,408	..	....	...
May.........	10	6	2,259	..	..	147	2,259	..	6,500	311
June........	9	6	2,797	..	..	142	2,797	..	....	...
July........	8	5	2,443	..	..	215	2,443	..	5,833	195
Aug.........	10	5	3,252	..	..	271	3,252	..	....	...
Sept........	11	6	3,479	..	..	208	3,479	40	7,395	193
Oct.........	7	5	5,427	..	20	203	5,447	..	....	...
Nov.........	7	5	3,191	..	..	215	3,191	50	1,950	188
Dec.........	9	5	3,537	..	..	192	2,537	..	....	...
Total	105	67	34,831	139	23	2,145	34,993	90	28,408	1,925

FRUITS AND VEGETABLES RECEIVED IN HONOLULU DURING 1913.

	Jan	Feb.	Mar.	Apr	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Apples	3,519	3,606	5,527	2,425	1,884	812	856	3,397	6,681	8,000	6,239	6,685	49,631
Apricots	..	..	..	..	31	1,011	209	15	1	14	..	..	1,281
Artichokes	13	26	21	27	34	23	16	9	9	5	12	16	211
Beans	40	97	136	139	198	58	13	150	210	178	130	187	1,536
Cabbage	438	265	201	69	25	100	136	247	299	157	103	188	2,228
Cabbage (Pake)	13	23	..	..	..	..	..	..	..	..	27	35	98
Beets	26	3	22	2	5	..	10	..	15	38	21	26	168
Carrots	104	..	25	25	10	30	22	10	50	53	45	45	419
Cauliflower	193	254	223	168	220	244	213	170	246	145	196	224	2,496
Celery	103	78	123	89	68	66	140	146	273	176	254	207	1,723
Celery Root	..	..	..	..	..	..	..	..	1	..	5	3	9
Cherries	..	..	..	..	582	1,617	668	..	..	..	..	..	2,867
Cranberries	2	..	..	..	..	..	..	..	3	6	54	40	105
Rhubarb	4	7	36	45	58	47	23	4	1	8	6	11	250
Fruit	28	20	16	11	16	7	13	28	95	38	32	31	335
Garlic	71	76	73	63	24	57	73	103	73	68	45	52	778
Grape Fruit	83	69	142	121	116	116	73	18	32	68	81	145	1,064
Grapes	39	..	..	..	..	..	90	706	2,868	2,136	1,135	1,180	8,154
Horse Radish	8	11	6	9	10	4	5	4	8	7	8	7	87
Lemons	256	473	435	157	169	548	461	183	535	443	293	265	4,218
Limes	..	..	..	11	..	..	..	..	..	..	..	..	11
Megs	..	..	..	..	..	42	283	224	254	173	23	31	1,030
Melons	..	..	..	..	..	..	90	17	88	64	16	..	275
Nectarines	..	..	..	..	..	..	38	328	34	..	..	..	400
Nuts	61	110	73	59	32	46	190	79	165	75	291	348	1,529

Onions	2,061	1,354	1,724	283	113	1,801	1,953	2,161	2,113	1,998	1,179	2,430	19,170
Oranges	5,126	5,375	2,132	1,322	2,018	890	812	829	819	357	976	2,991	23,647
Parsnips	19	32	31	28	4	36	18	12	20	4	14	17	235
Peas	..	..	..	23	31	24	22	3	5	12	..	12	132
Peaches	..	..	..	..	..	714	1,277	1,571	2,052	734	40	..	6,388
Asparagus	..	1	53	96	78	55	24	..	..	1	2	1	311
Pears	28	18	..	..	..	..	449	653	1,221	890	280	241	3,780
Persimmons	20	..	..	..	..	..	..	..	10	252	492	325	1,099
Plants	111	38	80	64	69	66	37	23	69	27	52	278	914
Pomegranates	..	..	..	..	..	..	..	..	..	..	10	15	25
Plums	..	..	..	..	..	454	1,770	1,431	793	100	..	..	4,548
Prunes	10	..	..	..	..	..	50	20	64	..	..	..	144
Quinces	..	..	..	..	..	..	..	..	1	2	5	..	8
Seeds	68	99	147	97	85	53	31	38	104	84	66	106	978
Sprouts	22	26	9	4	..	..	..	..	9	11	12	23	116
Spuds	8,946	7,229	9,693	8,735	6,052	7,197	7,956	8,742	7,522	8,193	11,540	9,521	101,325
Squash	2	2	5	5	..	2	..	15	4	4	18	17	74
Sweet Potatoes	..	1	1	4	3	..	..	..	..	..	2	..	11
Tangerines	292	149	10	..	..	..	..	..	..	..	64	625	1,140
Tomatoes	..	7	..	..	1	1	..	2	..	..	..	..	11
Turnips	93	80	167	59	25	54	43	27	78	19	31	56	732
Trees	..	4	4	..	..	..	..	..	..	6	..	68	82
Vegetables	59	5	4	8	18	3	6	5	4	4	7	19	142
Bulbs	12	9	19	9	8	9	1	1	..	4	28	22	122
Total	21,870	19,547	21,138	14,157	11,986	16,187	18,071	21,371	26,829	24,554	23,834	26,493	246,037

FRUITS AND VEGETABLES RECEIVED IN HONOLULU DURING 1914.

	Jan	Feb.*	Mar.	Apr	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Apples	4,172	2,037	2,009	869	983	1,038	2,597	4,091	12,509	10,618	10,916	5,919	57,758
Apricots	..	..	..	..	40	633	140	22	5	..	..	..	840
Artichokes	5	8	29	36	27	28	15	3	3	6	24	36	220
Beans	400	635	386	251	120	175	43	245	263	264	15	419	3,216
Cabbage	129	40	29	5	..	33	35	91	381	360	379	169	1,651
Cabbage (Pake)	45	..	..	..	..	..	..	..	71	48	21	32	217
Beets	6	..	31	..	..	..	..	..	57	22	30	4	150
Carrots	27	6	32	..	..	..	..	..	80	22	48	51	266
Cauliflower	183	222	439	117	259	252	223	263	412	309	511	575	3,765
Celery	64	72	221	38	..	11	100	194	341	310	419	329	2,099
Celery Root	3	3	1	..	..	..	1	4	..	6	..	2	20
Cherries	..	..	..	..	1,092	1,426	47	..	6	..	..	..	2,571
Cranberries	3	..	..	..	..	..	..	..	3	13	30	32	81
Rhubarb	2	2	33	42	70	69	24	17	15	1	13	16	304
Fruit	25	46	26	20	21	40	21	44	47	36	23	44	393
Garlic	50	59	55	23	30	75	73	78	22	37	45	83	630
Grape Fruit	51	90	249	96	90	229	171	70	151	154	193	259	1,803
Grapes	16	..	..	..	..	..	207	1,462	3,168	2,121	1,943	470	9,387
Horse Radish	3	5	17	8	11	14	6	7	4	2	21	10	108
Lemons	212	133	631	260	377	573	316	442	376	261	259	382	4,222
Limes	..	..	..	..	..	..	4	..	..	..	..	3	7
Megs	..	..	..	..	..	302	290	289	502	252	181	62	1,878
Melons	..	..	..	..	..	..	..	..	4	..	..	..	4
Nectarines	..	..	..	..	..	..	64	261	..	..	..	..	325
Nuts	81	40	116	46	43	104	24	53	50	115	90	272	1,034

Onions	1,371	136	207	32	234	721	1,411	2,218	2,401	2,754	1,673	1,596	14,754
Oranges	4,703	2,619	3,093	3,647	3,725	3,637	2,843	1,638	2,486	2,197	2,478	4,984	38.050
Parsnips	11	23	27	1	6	38	15	20	36	5	21	31	234
Peas	16	5	18	27	53	36	28	8	..	..	..	5	196
Peaches	5	..	..	..	20	1,154	1,388	1,091	1,707	231	..	..	5,596
Asparagus	..	..	61	70	80	57	11	..	..	..	..	..	279
Pears	13	7	..	..	..	23	505	716	1,107	1,089	691	283	4,434
Persimmons	16	..	..	..	..	..	..	..	33	377	845	238	1,509
Plants	53	73	107	75	75	56	28	16	39	38	62	132	754
Sugar Cane	..	..	..	1	..	..	..	..	..	..	..	..	1
Plums	..	..	..	..	..	905	1,531	1,324	714	33	..	..	4,507
Prunes	..	..	..	..	..	..	..	..	29	..	..	..	29
Quinces	..	..	..	..	..	..	..	5	3	4	..	4	16
Seeds	88	113	231	82	117	63	80	36	102	83	100	133	1,228
Sprouts	6	6	3	..	..	..	..	..	8	5	15	36	79
Spuds	7,491	6,916	13,265	9,624	5,525	7,322	7,006	7,716	9,529	8,286	7,159	10,703	100,542
Squash	2	4	2	..	1	3	1	11	20	2	18	17	81
Sweet Potatoes	4	4	2	..	2	2	..	..	..	1	..	..	15
Tangerines	1,451	541	858	392	39	..	..	..	..	..	121	1,720	5,122
Tomatoes	..	1	..	1	..	..	..	..	1	1	2	6	12
Turnips	31	35	74	14	33	45	48	39	92	14	36	87	548
Trees	11	2	1	1	1	..	..	..	..	2	..	81	99
Vegetables	11	7	12	9	9	4	..	11	8	5	7	15	98
Bulbs	16	9	19	15	13	10	4	..	..	8	15	19	128
Total	20,776	13,899	22,284	15,802	13,096	19,078	19,300	22,485	36,785	30,092	28,404	29,259	271,260

FRUITS AND VEGETABLES RECEIVED IN HONOLULU DURING 1913—FOREIGN

	Jan.	Feb.	Mar.	Apr	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Apples	3	7	17	10	8	7	2	7	2	11	13	17	104
Water Chestnuts	90	22	49	33	74	55	61	42	..	6	9	5	446
Beans	446	61	1	231	200	61	228	74	95	..	144	..	1,541
Bananas	1	..	..	..	..	..	..	..	..	..	..	..	1
G. Chestnuts	36	4	8	2	..	..	..	1	..	10	82	9	152
Caladiums	171	32	105	10	..	..	..	..	..	..	..	26	344
Cocoanuts	..	..	..	..	..	6	..	250	..	..	24	..	280
Lily Roots	..	..	..	..	..	..	..	7	1	4	3	..	15
Fruit	..	2	1	..	..	..	..	1	1	..	1	1	7
Garlic	2	..	6	7	41	32	8	2	1	1	1	2	103
Grape Fruit	9	2	11	9	15	16	3	4	..	3	3	6	81
Herbs	..	..	..	..	..	..	..	3	..	..	..	..	3
Horse Radish	4	..	7	2	1	..	..	3	..	3	3	16	39
Lemons	3	2	1	1	..	8	..	..	..	1	2	2	20
Yams	64	8	33	22	65	39	57	25	42	52	145	19	571
Ginger	35	16	33	11	50	36	39	16	33	41	51	6	367
White Nuts	16	6	1	..	1	..	..	..	..	9	13	4	50
Water Caltropes	..	..	..	..	..	..	..	1	2	..	..	..	3
Nuts	..	10	1	..	..	..	..	..	1	..	..	..	12
Onions	959	1,066	631	792	538	..	5	1	2	6	1	6	4,007

Oranges	12	8	16	9	5	9	..	2	..	2	9	7	79
Olives	5	..	8	..	..	..	..	..	..	..	2	3	18
Peaches	..	..	..	..	..	..	7	..	..	..	..	..	7
Peanuts	200	53	106	171	291	..	136	..	..	..	229	..	1,186
Sand	6	8	11	6	10	4	3	5	17	12	16	11	109
Persimmons	..	..	..	..	..	..	..	..	1	1	3	2	7
Plants	212	10	342	57	270	30	459	31	6	337	19	2,110	3,883
Pomelo	2	1	1	..	..	1	..	..	..	..	1	1	7
Pomegranate	..	..	..	1	..	..	..	..	..	..	..	..	1
Pumpkins	1	..	..	..	..	..	..	..	..	..	..	..	1
Seeds	31	18	50	49	28	523	25	17	29	68	58	22	918
Bamboo Shoots	4	..	..	3	2	..	..	..	..	..	..	..	9
Spuds	1	..	3	1	4	5	..	..	..	3	..	1	18
Squash	..	..	..	1	..	..	..	..	..	..	..	..	1
Sweet Potatoes	35	10	19	6	17	14	12	14	5	4	14	4	154
Tangerines	29	10	8	1	1	..	..	1	..	..	13	19	82
Taro	..	..	3	3	2	..	..	2	3	..	2	..	15
Vegetables	..	2	3	2	..	1	1	3	..	3	4	1	20
Bulbs	35	3	24	1	103	2	26	..	6	40	151	4	395
Total	2,412	1,361	1,499	1,441	1,726	849	1,072	512	247	617	1,016	2,304	15,066

FRUITS AND VEGETABLES RECEIVED IN HONOLULU DURING 1914—FOREIGN.

	Jan.	Feb.	Mar.	Apr	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Apples	13	8	11	15	6	6	4	3	2	8	11	5	92
Water Chestnuts	86	43	33	62	17	94	26	51	15	35	74	..	536
Asparagus	..	..	1	..	..	1	..	1	..	..	..	..	3
Beans	..	110	..	10	131	2	893	108	..	..	..	427	1,681
Bananas	..	..	..	..	..	..	..	..	..	..	..	..	
G. Chestnuts	93	12	7	14	..	6	..	..	..	..	13	47	192
Caladiums	448	155	126	2	..	..	..	..	..	..	..	..	731
Cocoanuts	46	..	2	4,007	62	..	..	..	..	1	..	..	4,118
Lily Roots	11	..	..	..	..	..	..	..	..	..	..	1	12
Fruit	2	3	..	2	3	..	3	..	..	..	..	..	13
Garlic	9	..	58	91	16	78	14	48	..	13	22	2	351
Grape Fruit	3	3	12	9	5	9	4	9	..	1	..	4	59
Horse Radish	9	..	3	2	..	3	..	..	..	..	..	4	21
Lemons	..	1	..	1	..	1	..	..	..	..	..	..	3
Yams	64	8	41	78	25	108	25	71	8	72	106	33	639
Ginger	29	2	37	43	15	90	25	36	15	37	45	20	394
White Nuts	14	4	5	2	..	..	..	..	..	..	53	11	89
Nuts	..	3	..	2	1	1	..	..	..	..	..	5	12
Onions	1,081	802	954	1,426	550	300	..	1	..	..	..	1	5,115
Oranges	32	14	27	15	2	5	6	3	4	9	5	12	134

Sugar Cane	1	..	..	..	..	..	..	..	..	..	..	..	1
Olives	1	..	..	..	..	..	..	..	..	..	..	1	2
Peanuts	215	140	463	143	260	226	238	192	30	82	580	106	2,775
Sand	4	3	3	4	4	8	2	10	2	5	4	4	53
Persimmons	..	..	..	..	..	..	..	..	..	..	3	..	3
Plants	1,130	110	14	3,786	34	6	38	43	103	1	1,342	1,358	7,965
Pomegranates	..	..	..	..	..	..	..	..	..	..	1	..	1
Pomelo	15	..	1	..	..	..	1	..	3	..	7	..	27
Seeds	72	14	64	56	27	61	77	77	81	83	79	58	749
Bamboo Shoots	..	..	1	..	..	..	..	..	..	..	..	..	1
Spuds	1	38	..	..	..	..	..	..	..	1	..	..	40
Squash Corn	..	..	..	..	..	..	..	100	139	..	..	..	239
Sweet Potatoes	42	7	15	11	18	28	3	14	4	10	1	4	157
Tangerines	28	7	8	6	..	..	..	..	..	..	7	14	70
Taro	2	..	..	6	1	3	2	2	..	..	..	3	19
Trees	..	..	..	..	2	..	..	..	..	..	..	..	2
Vegetables	..	..	..	..	..	..	1	..	..	..	..	..	1
Bulbs	45	2	1	..	1	7	1	..	..	21	49	117	244
Total	3,496	1,489	1,887	9,793	1,180	1,043	1,363	769	406	379	2,502	2,237	26,544

FRUITS AND VEGETABLES RECEIVED IN HILO DURING 1913.

	Jan.	Feb.	Mar.	Apr	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Apples	1,045	525	811	150	154	134	125	577	1,074	1,441	1,665	1,478	9,179
Apricots	..	..	..	..	..	50	55	..	..	..	..	..	105
Artichokes	1	1	9	3	4	2	..	..	1	9	5	4	39
Beans	..	..	1	18	296	210	135	190	215	..	..	..	1,065
Cabbage	..	..	..	..	..	..	..	..	..	..	..	..	..
Beets	..	..	1	..	1	..	..	..	..	..	..	..	2
Carrots	..	..	1	..	1	..	..	..	..	..	..	..	2
Cauliflower	12	13	19	10	17	17	8	11	9	20	16	22	174
Celery	2	4	6	2	3	1	..	6	6	25	25	18	98
Cherries	..	..	..	..	8	171	40	..	..	..	..	..	219
Cranberries	..	..	..	..	..	..	..	..	..	..	5	12	17
Asparagus	..	..	8	2	..	..	..	..	..	..	..	..	10
Fruit	..	..	..	..	..	..	..	..	..	..	..	5	5
Garlic	10	8	10	5	13	13	15	21	28	20	10	11	164
Grape Fruit	6	15	11	11	18	14	10	12	13	22	10	19	161
Grapes	3	..	..	..	..	..	..	216	97	264	175	81	836
Horse Radish	..	..	1	..	..	..	..	..	..	..	..	..	1
Lemons	18	21	78	21	16	16	27	33	35	18	25	61	369
Rhubarb	1	2	..	5	3	3	5	4	..	1	..	..	24
Melons	..	..	..	..	..	..	17	54	35	54	..	2	162
Nectarines	..	..	..	..	..	..	..	24	22	..	..	..	46

Nuts	15	..	..	5	7	9	..	5	5	10	85	17	158
Onions	264	134	91	35	147	119	199	380	424	339	232	180	2,544
Oranges	415	310	515	245	301	158	150	215	165	53	335	857	3,719
Parsnips	..	..	..	..	1	..	..	..	..	..	..	..	1
Peas	..	..	1	..	1	..	..	..	..	..	..	..	2
Peaches	..	..	..	..	..	7	95	136	99	227	..	..	564
Peppers	..	..	1	..	..	..	..	..	..	..	..	..	1
Pears	6	..	..	..	..	..	60	80	38	33	20	10	247
Persimmons	..	..	..	..	..	..	..	..	..	88	152	10	250
Plants	5	8	9	8	6	7	..	1	..	..	5	5	54
Plums	..	..	..	..	..	..	105	180	61	63	20	..	429
Pomegranates	..	..	..	..	..	..	..	..	15	117	269	..	401
Seeds	7	10	14	13	8	8	8	3	2	..	10	8	91
Sprouts	1	..	..	..	..	..	..	..	..	..	..	..	1
Spuds	1,288	936	1,195	635	1,375	926	1,028	1,214	1,044	1,206	1,071	1,352	13,270
Tangerines	150	50	..	..	..	..	..	..	..	..	35	159	394
Tomatoes	..	..	1	..	..	..	..	1	..	..	..	..	2
Turnips	..	..	..	..	..	..	..	..	..	..	2	4	6
Vegetables	..	..	..	..	1	1	..	..	..	..	..	1	3
Total	3,249	2,037	2,783	1,168	2,381	1,866	2,082	3,363	3,388	4,010	4,172	4,316	34,814

FRUITS AND VEGETABLES RECEIVED IN HILO DURING 1914.

	Jan	Feb.	Mar.	Apr	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Apples	361	362	352	280	250	325	150	704	747	1,745	1,226	1,291	7,793
Apricots	..	..	..	..	15	55	..	..	..	..	..	..	70
Artichokes	..	4	4	9	5	3	5	..	..	3	..	2	35
Beans	..	..	..	..	95	..	..	..	..	..	..	..	95
Cabbage	..	..	..	..	..	..	..	..	..	..	11	7	18
Cauliflower	14	35	35	15	19	9	35	11	16	38	29	21	277
Celery	16	18	18	4	..	..	5	9	10	38	16	14	148
Cherries	..	..	..	..	220	117	2	..	..	..	..	..	339
Cranberries	..	..	..	..	..	..	..	..	..	..	7	2	9
Rhubarb	..	2	2	4	4	1	1	..	..	..	..	..	14
Fruit	..	..	..	..	2	..	..	1	..	..	..	..	3
Garlic	6	..	..	..	10	8	28	18	7	14	6	10	107
Grape Fruit	10	10	10	14	14	15	14	28	19	30	23	13	200
Grapes	..	..	..	..	..	6	44	145	108	199	75	43	620
Horse Radish	..	..	..	5	..	..	..	..	..	..	..	..	5
Lemons	12	32	32	29	57	24	29	26	19	35	31	38	364
Megs	..	..	..	..	2	15	39	48	31	49	12	14	210
Nectarines	..	..	..	..	..	..	..	3	..	..	..	..	3
Nuts	9	..	..	..	..	..	..	..	..	..	35	14	58

Onions	269	111	103	85	112	307	361	308	252	558	254	232	2,952
Oranges	425	308	298	490	675	350	287	566	510	751	445	475	5,580
Parsnips	1	..	..	..	..	..	..	..	..	..	..	..	1
Peas	..	..	..	..	..	1	..	..	..	..	2	..	3
Peaches	..	..	..	..	10	54	59	36	72	49	..	..	280
Asparagus	..	..	..	5	7	3	..	..	..	..	..	..	15
Pears	9	5	5	..	..	..	..	78	40	69	20	2	228
Persimmons	..	..	..	..	..	..	..	..	..	78	51	45	174
Plants	..	13	13	9	9	..	2	..	..	..	..	..	46
Plums	..	..	..	..	..	27	97	101	46	..	..	..	271
Prunes-Pomegrts. ...	..	..	..	..	..	..	..	..	20	40	5	..	65
Seeds	5	26	26	13	7	4	2	5	5	12	25	15	145
Spuds	1,030	1,010	1,000	1,428	717	1,454	1,281	1,164	1,575	1,736	846	1,122	14,363
Squash	..	..	..	..	..	3	..	..	..	..	..	..	3
Tangerines	108	23	23	15	23	12	..	..	..	..	65	176	445
Tomatoes	..	..	..	..	..	..	..	..	..	1	1	..	2
Turnips	8	3	3	..	4	1	..	..	2	2	3	1	27
Vegetables	11	..	..	3	2	2	2	1	..	..	3	..	25
Total	2,294	1,962	1,924	2,408	2,259	2,797	2,443	3,252	3,479	5,447	3,191	3,537	34,993

INTER-ISLAND REPORT, 1913-1914.

Month.		PASSED.				REJECTED.				
	Steamers Inspected.	Plants.	Fruit.	Vegs.	Total.	Plants.	Fruit.	Vegs.	Total.	Total Inspected.
1913										
January	62	66	1	832	899	12	15	6	33	932
February	54	43	..	701	744	10	16	..	26	770
March	58	91	..	811	902	8	14	..	22	924
April	62	80	8	766	854	14	21	1	36	890
May	68	475	16	750	1,241	21	16	4	41	1,282
June	56	64	23	664	751	6	20	..	26	777
July	69	807	7	693	1,507	11	10	..	21	1,528
August	57	856	12	700	1,568	28	9	..	37	1,605
September	63	387	16	603	1,006	12	11	..	33	1,029
October	58	34	45	643	772	11	8	2	21	743
November	51	625	20	968	1,613	10	6	1	17	1,630
December	58	392	26	1,107	1,525	12	10	1	23	1,548
1914										
January	56	76	12	1,126	1,214	9	13	..	22	1,236
February	52	78	18	1,002	1,098	16	8	2	26	1,124
March	67	75	25	542	642	14	3	1	18	660
April	54	59	18	437	514	16	11	..	27	541
May	58	53	42	512	607	17	3	..	20	627
June	62	96	28	676	800	7	6	2	15	815
July	60	75	12	739	826	16	12	1	29	855
August	61	86	14	792	892	14	26	..	40	932
September	63	62	..	1,035	1,097	8	28	..	36	1,133
October	62	83	..	710	793	26	17	..	43	836
November	60	77	..	517	594	21	17	..	38	632
December	67	68	3	768	839	9	8	1	18	857
Total	1,438	4,808	346	18,094	23,298	328	308	22	668	23,906

The preceding tables give an exact account of the amount of lots and packages of fruit, vegetables, seeds and plants arriving at Honolulu, and Hilo during each month of 1913 and 1914; also the disposal of the various shipments. A separate table for each year also shows the foreign shipments and their disposal. No fruits or vegetables are allowed entry from any of the Oriental ports nor from Australasia nor any of the Pacific Islands. All shipments from Mexico and Central America direct or via Pacific Coast ports are also prohibited. With our present facilities very few plants are now hauled from one dock to another for treatment, these being from Pacific Coast ports only, and mosto f these are brought by the Matson Navigation Company's boats. We have not as yet transferred our fumigating room from the old Matson Wharf or Hackfeld Wharf, Pier No. 16, as there is no suitable place for it on the new Matson Wharf, Pier No. 15, and as there are possibilities of rearranging some of the wharves in the near future, I thought best not to change the situation at the present time.

PESTS INTERCEPTED.

In our inspection work we naturally find a great variety of pests. Some very injurious insects of other countries have been discovered in our search during the biennial period. Probably the most remarkable seizure ever made by the division took place in the Post Office—a package of tree twigs from Japan aws held for our inspection, and on opening the same hollow tree twigs were found with the opening at each end plugged up with twisted grass. A closer examination disclosed the fact that each twig contained a good, fat live borer. We were at a loss to know the object of this sending, but from a Japanese letter enclosed in the package we got the following story:

"Greetings; this time I am sending you some medicine good for consumption. Open the twigs and you will find a worm (*Sabutori-mushi*) in each twig. Take out one and wrap it in sembi or ame and swallow it alive. The juice of the living worm is good for the disease. However, if the worms are dead, you can bake them until black and powder them up and drink it with sake. Those I send will constitute a dose for one week. (There were 12 live grubs in the package.) When you take the worms please inform me if you digest the same. If you should find any such worms in Hawaii continue taking same for some time, etc., etc."

The worms found in the twigs represented two distinct orders of insects. Some were the grubs of a large stem boring beetle belonging to the *Cerambicidae*; the others were the larvae of some stem boring moth. The package was destined to the Island of

Maui, and was seized and the twigs and larvae are the property of the Board museum as alcoholic specimens. This illustrates another channel through which some serious pest might enter the Territory. Worm diet for the cure of the White Plague might be all right in Japan, but we have not as yet heard of this method being used here, and we surely shall not allow a trial with imported borers such as were found in this mail package. Since the arrival of the first package we found another with the same species of borers, also a bamboo tube in the baggage of a Japanese immigrant, containing 18 grubs; these, however, had been baked beforehand. They also have added to our ever-growing exhibit. On several occasions we have found the grubs of the Japanese rosebeetle, the Anomala beetle and *Sericea Japonica* closely allied to it, also grubs of a small weevil attacking the fibrous roots of plants in the soil attached to nursery stock coming from Japan. These are all serious pests as we well know from past experiences. I am told by Mr. F. Muir that the small weevil is a very serious pest to potted plants in Japan. The Orchid borer (*Acytheopeus aterrimus*) is frequently found in Dendrobiums from the Philippines. The beetle would cause serious damage to Orchids here and might for the lack of food attack other plants if ever introduced. All Orchids are very carefully examined before they are permitted to enter the Territory. On two occasions we found the larvae and pupae of a large *Cicada*. Once among the roots of pot plants from Japan and again in the soil and packing of a shipment of Orchids from Manila, P.I. Cicadas Locusts or Harvest flies, as they are commonly called, are very injurious insects in many parts of the world. The seventeen year locust of the United States has done such serious damage that volumes have been written and thousands spent in the fight against it. There are no Cicadas known in the Territory.

Another incident of a possible way by which pests could be introduced was illustrated by the finding of two hairy caterpillars crawling on the coat-sleeve of an immigration inspector while on duty on board of an Oriental boat. A search was made for the source of these caterpillars, and a plant belonging to the steamer and located in the lobby near the stairs had been infested and the foliage had been seriously eaten. No other caterpillars were found. The man had probably brushed against the plant or had come in contact with it while standing near the same. It would have been a very serious matter for the caterpillars to have been carried off the steamer onto the dock, and they could have easily dropped off of the sleeve on the street near some hedge or garden.

A large number of insects in many orders, also slugs, snails, crustaceans, centipeds and millipeds have been taken in the soil and packing around plants from Australia,

Plate 16. Fig. 1. **Mail shipment of twigs from Japan containing wood boring larvae.**

Plate 16. Fig. 2. **Wood boring larvae sent from Japan for medicinal purposes and taken in quarantine at post office.**

Asia and Islands of the Pacific. Too little is known of many of these, but it is safe to say that many of them would, no doubt, prove extremely troublesome to our beautiful gardens. The fruit shipments from the Pacific Coast as a whole arrive in a very clean condition, and the quality of these shipments has vastly improved during the last two years. It was found necessary to clean the boxes of several apple shipments from San Francisco in which the larvae of the codling moth had crawled and pupated, the fruit being in good, clean condition. I can only account for this as being a case of careless storage among inferior wormy fruit in some packing house on the Coast.

On one occasion a package of sugar cane, known as Japanese sugar cane, arrived by mail from Florida, and was consigned to a party on Maui. On examining the sugar cane I found it infested with a disease, *Colletotrichum falcatum,* kindly determined for me by Dr. H. L. Lyon, of the Hawaiian Sugar Planters' Association. The package was burned in Lucas' mill, and the party received a quantity of good clean Japanese cane from Mr. Agee, of the H.S.P.A., at my request.

PESTS INTERCEPTED IN COURSE OF INSPECTION.

Unfortunately the identification of many species taken has been left undone because of the great rush of work in other lines. However, all material on hand is in good condition, with accurate data, so that when time permits, the identification of the same can be undertaken.

Bugs (*Hemiptera-Homoptera*).

Aradid sp., on orchids, Manila.
Cicada sp., in soil and packing of plants, Japan, Manila.
Reduviid sp. in plant packing, Manila.
Pentatomid sp. in plant packing, Manila.
Capsid sp. taken four times in plant packing, Manila.
Hemipterous nymph., in soil, Japan.

Scale Insects.

Aspidiotus cyanophylli on orchids, U.S.A.
Aspidiotus hartii on yams, Guam.
Aspidiotus rapax on mistletoe, laurel and apples, U.S.A.
Chionaspis mussaendae on hibiscus, Samoa.
Chrysomphalus biformis on orchids, Manila.
Coccus hesperidum on citrus, New York.
Diaspis boisduvalii on orchids, New Jersey.
Fiorinia fioriniae on orchids Java, Strelitzia, California.
Hemichionaspis minor on hibiscus, Samoa and cocoanuts, Fanning Island.

Hemichionaspis aspidistrae on orchids, Australia.
Lepidosaphes cocculi on dendrobium, Manila.
Lepidosaphes beckii on oranges, Florida.
Parlatoria pergandii on orchids, Manila.
Pseudococcus citri on citrus, U.S.A.
Pseudococcus azaleae on azalea, Japan.
Pseudococcus longispinus on palms, Australia.
Pseudococcus species on ginger, Samoa.
" " on orchids, Costa Rica.
" " on palms, Samoa.
Pulvinaria camelicola on camellia, Japan.
Saissetia olea on oleander, U.S.A.
Saissetia olea on palms, Australia.
Saissetia nigra on hibiscus, Samoa.
Saissetia hemisphaerica on ardisea, Japan.

Plant Lice (*Aphididae*).

Macrosiphum rosae on rose plants, California.
Macrosiphum sanborni on chrysanthemums, California.
Mysus persicae on carnations, California.

White Flies (*Aleyrodidae*).

Aleyrodes spiracoides on jasmine and geraniums, U.S.A.
Aleyrodes citri on citrus, Japan.

Butterflies and Moths (*Lepidoptera*).

Anarsia lineatella on peaches, California.
Carpocapsa pomonella in apples, California.
Paralipsa modesta in rice and beans, Japan.
Sitotroga cerealella in corn, U.S.A.
Omphisa anastomosalis in sweet potatoes, China.
Isia isabella on potato bags, Seattle, U.S.A.
Lycaenid larva and pupa on dendrobium, Manila.
Leaf miner citrus leaves, Japan and Australia.
Sesiid larvae in bark of gardenia, Japan.
Larvae in roots of plants, Japan.
Larva in sunflower seed, Portugal.
Larvae in hollow twigs, Japan.
Larvae in cocoanut sprouts, Palmyra Isles.
Larvae on camellia, Japan.
Caterpillars on coat of inspector, Japan.
Caterpillars on ornamental plants, Japan.

Beetles (*Coleoptera*).

Carabid in moss, California.
Carabid on merchandise, California.
Bembidium in plant packing, Manila.

Carabid in plant packing, California.
Carabid (four species) in orchid shipment, Manila.
Dytiscid in orchid shipment, Manila.
Hydrophilus on iris roots, Japan.
Pselaphid in orchid shipment, Manila.
Sylphid on merchandise, California.
Staphylinid (2 species) plant packing, California.
" (3 species) in orchid shipment, Manila.
Silvanus surinamensis in plant packing, Manila.
Dermestes vulpinus in baggage, Japan.
Elaterid in banana roots, Manila.
Elaterid larvae in soil, Japan.
Elaterid in plant packing, California.
Agrilus in plant packing, California.
Necrobia rufipes in copra, Fanning Isles.
Clerid in orchid shipment, Manila.
Anomala orientalis larvae and pupae in soil, Japan.
Anomala larvae (2 species) in soil, Japan.
Serica japonica grub in soil, Japan.
Adoretus grubs in soil, Japan.
Lachnosterna grub in soil, California.
Cerambycid grub in plant stems, Japan.
Cerambycid grubs in hollow twigs, Japan.
Chrysomelid in plant packing, Australia.
Flea beetle in dendrobium flower, Manila.
Epitrix in plant packing, California.
Flea beetle in azalea, Japan.
Chrysomelid in plant packing, California.
Bruchus chinensis in peas and beans, Japan.
Bruchus pisorum in horse beans, Spain and Portugal.
Bruchus prosopis in prosopis pods, Arizona.
Alphitobius piceous in banana roots, Manila.
" " in plant packing, various countries.
Balaninus grubs, in chestnuts, Japan and U.S.A.
Cryptorhynchus species in Heritera seeds, Manila.
Sphenophorus sordidus grubs in banana roots, Manila.
Cylas formicarius in sweet potatoes, Orient.
Acytheopeus aterrimus in orchid stems, Manila.
Curculionid (2 species) in orchid stems, Manila.
Weevil grubs and pupae in roots of plants, Japan.
Calandra granaria in corn, U.S.A.
Calandra oryzae in rice, Japan.
Calandra species in seeds, Australia.
Araeocerus species in Fiziphus seeds, Manila.

Ants, Bees and Wasps (*Hymenoptera*).

Habrobracon habitor on infested rice and packing, Japan, California.
Bethelid species in plant packing, California.
Dolichoderus bituberculatus in soil, Manila.
Euponera leutipes in orchid shipment, Manila.
Formica species in soil, Japan.
Lasius niger in soil, Japan.
Monomorium pharaonis in soil and packing, Manila.
Monomorium vastator in soil, Japan.
Monomorium floricolá in orchid shipment, Manila.
Solenopsis geminata in baggage, Spain.
Leptothorax species in moss, England.
Prenolepis longicornis in plant packing, Orient.
Prenolepis obscura in soil packing, Japan and Manila.
Prenolepis bourbonica in soil, Manila.
Prenolepis imparis in soil, California.
Ponera species soil and packing, Manila and Spain.
Solenopsis geminata soil, England.
Technomyrmex albipes orchid shipments, Manila.
Tetramorium guineense soil, Manila, Australia.
Tapinoma sessile plant packing, California.

Flies (*Diptera*).

Drosophila species on orchids, Manila.
Drosophila species in fruit, California.
Phorid species in soil, Japan.
Ptectus species in soil, Japan.
Phorbia brassica in turnips, California.
Tipulid species in soil, Japan.

Grasshoppers, Crickets and Roaches (*Orthoptera*).

Myrmocophilus species in soil, Manila.
Ectobia germanica in baggage, various countries.
Periplaneta americana in baggage, various countries.
Periplaneta australasiae in baggage, etc., various countries.
Blatta orientalis? nymph. in plant packing, Manila.
Epilampra inconspicua? in plant packing, Manila.
Oligotoma species in dead orchid stems, Manila.

Miscellaneous.

Tetranychus species on rose plants, California.
Bryobia species on jassamine, Ohio.
Tyroglyphus species on decaying plants, Manila.
Spider species in plant packing, various countries.
Centipeds in plant packing, various countries.

Millipeds in plant packing, various countries.
Oniscus species in plant packing, various countries.
Land shells, Opeas, Kaliella species in plant packing, various countries.
Veronacella species in plant packing, various countries.
Gecko species in plant packing, various countries.

Diseases (Fungi).

Cladosporium citri on citrus, Japan.
Citrus canker on orange, Japan.
Colletotrichum falcatum on sugar cane, Florida.
Fusicladium dendriticum on apples, California.
Glaeosporium species on apples, Japan.
Oospora scabies on potatoes, Pacific Coast.
Phragmidium subcorticatum on roses, U.S.A.
Puccinia arenariae on carnations, Pacific Coast.
Sphaerotheca pannosa on roses, Pacific Coast.

FEDERAL HORTICULTURAL BOARD.

In my biennial report of 1911-1912 I mentioned the fact of having been appointed collaborator of the Federal Horticultural Board, to supervise the inspection of the Federal plant quarantine act of August 20, 1912. During the years of 1913 and 1914 various rules and regulations known as quarantine notices have been passed and published prohibiting the introduction of certain plants, fruits and tubers from foreign countries, or prohibiting the transportation of these articles from infested areas on the mainland and from these islands to the mainland. Realizing the necessity of having assistance in case of illness or absence from the port of entry of the Territory, I requested that Mr. D. B. Kuhns and Mr. J. C. Bridwell be made collaborators, which request was granted, and since Mr. Bridwell's trip to Africa warranted his resignation as collaborator, I had Mr. Edward Drew appointed in his place. The additional powers we receive under Federal regulations have materially assisted us in regulating the unlisted small package usually brought in by tourists or friends of our citizens. Regulation 3 of the Plant Quarantine Act requires all importers of foreign plants to first make application to the Federal Horticultural Board for a permit, stating in the application the name and address of the exporter, the country where plants are grown, the port of entry and the name and address of the importer in the Territory to whom the permit should be sent. These applications for permits should be made in advance of shipment of nursery stock. During the biennial period our work has been materially strengthened by this regulation, and but very few shipments coming here have not had the required permits, and these were field in quarantine pending the arrival of a permit from Washington. The regulations have greatly discouraged the promiscuous fetching in of plants by the travelling public; plants which are gathered at random and packed in every kind of soil, moss or other material and have always proved a menace in the past. It is usually this small package wherein lies the greatest danger, and one of the main objects of the Federal Horticultural Board is to discourage this traffic. With the cooperation of the Post Office Department the Federal Horticultural Board has been able to cause the prohibition of all plant and seed shipments from foreign countries in the mails, so that many of the small packages of plants and seeds in the post offices, which were liable to be overlooked in the past, are now completely cut out, excepting such as are addressed to the United States Department of Agriculture, Washington, D. C., or their representatives in the various states or territories. This regulation is entirely in the hands of the postmaster, and does not affect flower, vegetable or field seeds. To import plants into this Territory the following requirements are absolutely necessary:

(1) The importer or his broker must first make application for a permit to import plants before ordering the same.

(2) Each package imported must bear the proper certificate of foreign inspection from countries which maintain official inspectors.

(3) Each package or container must be marked and must bear a certificate giving a list of all plants contained therein, the name of the shipper or grower, the name of the consignee and the locality where grown.

(4) Each shipment must be accompanied with a consular invoice and declaration not attached to the container but with the bill of lading.

Under the provisions of section 7 of the plant quarantine act of August 20, 1912, the following extracts of the various notices of quarantine might be of interest:

Quarantine No. 1. Superseded by Quarantine No. 7, prevents the introduction into the United States of the White Pine blister rust (*Peridermium strobi*) and forbids the importation of all five-leaved pines from each and every country of Europe and Asia.

Quarantine No. 2. Was published Sept. 18, 1912, to protect the United States from entry of the Mediterranean fruit fly, now thoroughly established in the Hawaiian Islands, and it prohibits the shipment of any of the fruits and vegetables specified in the Notice of Quarantine into or through any other State, Territory or District of the United States.

Quarantine No. 3. Was published September 20, 1912, to prevent the introduction into the United States of the disease known as *Potato wart, Potato canker* or *Black scab,* and forbids the importation into the United States from Newfoundland, Islands of St. Pierre and Miguelon, Great Britain and Ireland, Germany and Austria-Hungary, of the common Irish potato (*Solanum tuberosum*). This is a very important quarantine for these Islands, as most of our Irish potatoes are imported, and what few potatoes are grown here are free from any very serious disease.

Quarantine No. 4, revised and amended as No. 10 and published June 24, 1913, describes and quarantines the districts in New England infested by the Gypsy Moth and Brown Tail Moth, and makes regulations governing the movement in interstate commerce of plants and plant products which may be infested from the areas quarantined.

Quarantine No. 5, published January 15, 1913, prevents the introduction into the United States from Mexico of the insect known as the Mexican fruit fly (*Trypeta ludens*), and prohibits the importation from that country into the United States of oranges, sweet limes, mangoes, sapotes, peaches, guavas and plums. It was amended February 8, 1913, to in include also grapefruit and its horticultural varieties.

Quarantine No. 6 was published March 1, 1913, for the purpose of preventing further distribution in the United States of two serious date palm scale insects (*Phoenicococcus marlatti* and *Paralatoria blanchardi).* It quarantines certain counties in California, Arizona and Texas, where these pests exist, and makes regulations governing the interstate movement of date palms grown within the areas quarantined.

Quarantine No. 8 was published on May 28, 1913, to prevent the introduction into the United States of the Pink Boll Worm *(Gelechia gossypiella)* of cotton, and forbids the importation into the United States of cotton seed of all species and varieties and cotton seed hulls from any foreign locality and country, excepting only the locality of the Imperial Valley in the State of Lower California, Mexico.

Quarantine No. 9 was published June 24, 1913, and applies to the Territory of Hawaii and prevents the exportation of all cotton seed and cotton seed hulls from this Territory into or through any other State, Territory, or District of the United States, also on account of the Pink Cotton Boll worm, which exists in Hawaii.

Quarantine No. 11 was published December 22, 1913, to prevent the introduction into the United States of serious diseases of the Irish potato, including the powdery scab *(Spongospora subterranea),* known to exist in Canada, Newfoundland, the Islands of St. Pierre and Miguelon, Great Britain, Ireland and Continental Europe. Like the notice of quarantine No. 3, this ruling is also of very great importance to this Territory owing to the enormous shipments of potatoes coming here as imports.

Quarantine No. 12 was published February 27, 1914, and regulates the importations of Avocado seed. The Avocado weevil *(Heilipus lauri)* is a very serious and injurious pest which exists in Mexico and Central America. In order to prevent the introduction of this pest, the importation into the United States of the seeds of the Avocado or Alligator Pear is entirely prohibited.

Quarantine No. 13 was published on March 23, 1914, for the purpose of prohibitng the exportation of certain fruits and vegetables from the Hawaiian Islands on account of two dangerous insects, the Mediterranean fruit fly *(Ceratitis capitata)* and the Melon fly *(Dacus cucurbitae),* into or through any State, Territory or District of the United States. A full list of fruits and vegetables is given. A full set of regulations is included. Bananas and Pineapples can be exported under supervision and inspection.

Quarantine No. 14 was published April 25, 1914, to extend the quarantine against the powdery scab *(Spongospora subterranea)* to the State of Maine, where the disease is known to exist.

Quarantine No. 15 was published on June 6, 1914, for the purpose of preventing the introduction into the United States of insects and fungous diseases of sugar cane existing in foreign countries. This quarantine does not affect Hawaii or Porto Rico.

Quarantine No. 16, published the same date, forbids exporting living canes of sugar cane or cuttings or parts thereof from the Territories of Hawaii or Porto Rico into or through any State, Territory or District of the United States, regardless of the use for which they may be intended.

Quarantine No. 17 was published July 3, 1914, for the purpose of quarantining certain areas in the United States containing two injurious insects known as the Gypsy Moth *(Porthetria dispar)* and the Brown-Tail Moth *(Euproctis chrysorrhoea)* and preventing coniferous trees, described as "Christmas trees" and "Christmas greens or greenery" and forest plant products and other plant products for planting or propagating, from being moved inter-state from any point of the areas mentioned in the quarantine act. It also prescribes Gipsy Moth regulations and Brown-tail Moth regulations concerning the packing, marking, shipping, inspection, etc., etc.

Quarantine No. 18 was published November 14, 1914, to extend the quarantine against the Powdery Scab *(Spongospora subterranea)* to the State of New York where the disease is known to exist, and prohibits the movements of Irish potatoes from the

State of New York into or through any other State, Territory or District of the United States.

Quarantine No. 19 was published December 10, 1914, for the purpose of prohibiting the importation of all citrus nursery stock, including buds, scions, and seeds, from Europe, Asia, Africa, South America, North America outside of the United States, and foreign Oceanic countries and Islands on account of a very serious disease of the Citrus known as the Citrus Canker. The disease Citrus Canker has only recently been found in Florida, U. S. A., and from accounts has done considerable damage to citrus groves in "various" sections of that State. The disease must have been present there for some time but like so many similar diseases, was overlooked or taken for scab, scaly bark or Anthracnose. It has been found on *Citrus trifoliata* from Japan. I have condemned several shipments of young citrus trees coming into the Territory showing some scabby growth, and some fruit, which is prohibited and showed signs of a disease which no doubt was Citrus Canker. Under the enforcement of Quarantine No. 19 all danger of importing infested citrus plants in the future is passed.

INSECT PESTS AND REMEDIES.

During the past two years the following insects have proven quite a menace to plant life in and around Honolulu as well as in some districts on the other islands:

Japanese Rose Beetle (Adoretus tennimaculatus).

Probably this beetle has caused more annoyance to people than any other pest we have. Owing to severe dry spells during the early summer, especially in 1914, there was a very material increase of this pest in the drier sections. Not only was the damage reported by the flower lover, but the vegetable grower had great destruction wrought to his beans, egg plant and other tender growth, and at times it no doubt seemed intolerable. There is no question but that the adult and larva of this species is kept in check by the beetle fungus when climatic conditions are right, that is to say, when we have warm moist weather to induce the spread of the fungus. But, when such conditions do not exist for a period of six months, the beetle becomes very abundant and very destructive. Collecting beetles at night has been tried by some who cared a great deal for their plants, but while many people will do this collecting regularly and conscientiously the next door neighbor will not bother about the pest, and after his plants have fed a multitude of beetles and they are left leafless the beetles soon migrate to the neighbors' gardens and all the work has to be done over again, which at best is most discouraging.

Cocoanut Palm Leaf Roller (Omiodes blackburni).

The adult of this caterpillar is not much observed or known by the general public, nor are the inconspicuous egg masses often seen, but the caterpillar or leaf roller is the individual who does attract attention when the beautiful new palm leaves begin to look ragged with streaks of brown. Generally speaking, although the insect is constantly present, attacking the cocoanut and native palms, very little complaint has been made until this year. Young cocoanut plantings on Oahu as well as Kauai suffered very severely and much inquiry fell into our hands. The pest usually is kept in check by the several parasites attacking the eggs, larvae and pupae, and the serious attack this year can probably be accounted for by unfavorable weather conditions for the rapid increase of the parasites. In two localities, one on Oahu and one on Kauai, groves which are partly protected by good windbreaks show a decided difference where the palms are in the lee of the windbreak over the palms which get the full benefit of strong winds. It is natural to expect some such difference so far as the minute parasites are concerned, for they must have quite a struggle to spread from palm to palm, where strong winds have been existing for any length of time. Some of the growers are going to plant more windbreaks as they can readily see the difference in their own groves.

Alligator Pear Bark Beetle (Xyleborus immaturus).

Much complaint has reached this Division of the damage done to the limbs and trunks of the alligator pear tree. The damage generally has quite progressed before it is noticed. The pest, which is a very minute black oblong beetle, bores into the dying bark, deposits its eggs, and the larvae work under the bark and into the wood. When the insects are quite abundant they very often will attack even good healthy trees. The presence of the pest is generally noticed by a white powdery substance appearing on the limbs and trunk of the trees. If the trees show a few of the weaker or unhealthy limbs attacked, they should be removed as soon as possible and all affected spots should be cut out and a coating made of lime and crude oil applied. To prepare this crude oil whitewash, place twenty-five pounds of unslaked lime in a tub and put just enough water on to start it slaking, and when well started pour into it gradually one and a half gallons of crude oil. After the lime and oil have mixed well more water can be added if necessary; it should be well stirred and should have the consistency of thick cream. This when applied is a good repellant and also forms a very good coating for the affected parts.

Tree Roach (Eleutheroda dytiscoides).

Another pest which is causing much annoyance, especially to those who have large cypress trees and hedges or Thuya plants is the Tree Roach. This is a flat, blackish brown roach living out of doors in the branches of cypress and similar trees and hedges. It does severe damage to the smaller twigs and branches by gnawing off the bark, causing the twigs to turn brown and die. Single trees can be protected in a way by dislodging the roaches, either shaking or beating the limbs with a stick and then killing the roaches that fall to the ground, but where quantities are growing or in the hedgerow this procedure is too laborious or expensive. Stearn's Roach Paste has been successfully used, but on account of frequent showers it must be placed in a small box. A medium sized candy box or a wooden box of equal size can be used. A hole the size of a fifty cent piece is cut out at each end, take a slice of bread, smear the roach paste thickly on it and place it in the box and tie on the cover. Hang the box in the shade of the tree among the branches where the roaches cluster. The box will act as a shelter for the pest and will furnish them the poisoned food. The dead roaches will be found in the box as well as on the ground and care should be taken not to let the chickens or domestic animals have access to the yard. This same remedy will be very successful for our common house roach by placing the bread in the cupboard or on the shelves of the pantry or kitchen.

Cutworms.

Several species of cutworms which are the larvae of our Noctuid moths have caused considerable damage to growing crops. The cutworm does not feed during the day, and for this reason so many people are at a loss to know what insect is doing the damage to their plants. A search in the soil near the base of the plant will soon reveal the culprit, which is a smooth caterpillar from one to one and a half inches long and when found is generally curled up. When these worms are abundant they are capable of doing enormous damage. Collecting the worms during the day time when the field is not too extensive has given good results. However, a better and cheaper method is the use of poisoned bait, which is scattered near the plants attacked. The following formula has given good results:

BAIT FOR CUTWORMS.

Parisgreen or white arsenic	1	lb.
Molasses	½	Gal.
Bran	20	lbs.

Mix parisgreen or arsenic dry with bran, add molasses and just enough water to moisten the mass. Place the mixture in rows in the infested fields. Frequent rains will make it necessary to repeat the operation. The mixture should be placed beside rather than on the plant. Care must be taken to keep domestic animals out of the fields treated in this manner.

Mealy Bugs.

We have three species of mealy bugs which do considerable damage to outdoor plants and trees. Probably the alligator pear mealy bug (*Pseudococcus nipae*) which also attacks the fig and many other plants and palms, is the most serious and has caused a lot of inquiry. This insect generally appears like magic and after doing the damage and disfiguring the tree is gradually diminished by the various ladybug beetles ever present in these Islands. However, it is the young trees which seem to suffer the most, and unless aided by the judicious use of a strong soap and water spray they will become stunted and worthless. Next in line is the fluffy mealy bug (*P. filamentosus*), which has the tendency to poison the tender shoots of hibiscus, citrus and other plants, causing them to distort and dwarf the flowers, as well as tender branches. The third species of importance is the pineapple mealy bug, which not only infests the pineapple, but does severe damage to the roots of many flowering plants and bulbs. Cannas, tuberoses, coleus, amaryllis and many other plants suddenly become dwarfed and on taking them out of the ground the roots are one mass of whitish looking objects which are the pests here mentioned. All these species can easily be checked by using a soap wash made of one pound whale oil soap to three gallons of very hot water. After the soap is thoroughly dissolved the liquid should be applied quite warm, as most of these pests are greasy and the hot wash will take better hold on them.

Scale Insects.

The two species which give the most trouble and loss are the Florida red scale (*Chrysoniphalus aonidum*) and the Purple Scale (*Lepidosaphes beckii*). These insects are especially fond of citrus trees but also do serious injury to palms and other garden and house plants. The whale oil soap wash as recommended for mealy bugs will do much towards reducing these pests.

Plant Lice or Aphids.

Plant lice, like mealy bugs and scale insects, do very serious damage to tender growth. There are several species of Aphids in the islands which contribute to the damage and loss of crops, and which caused inquiry during the biennial period.

The *Cotton Aphis* (*Aphis gossypii*), which not only attacks cotton but many other plants is especially destructive to watermelon plants, and during 1913 and 1914 considerable complaint from various sections reached the office. It is a very hard problem

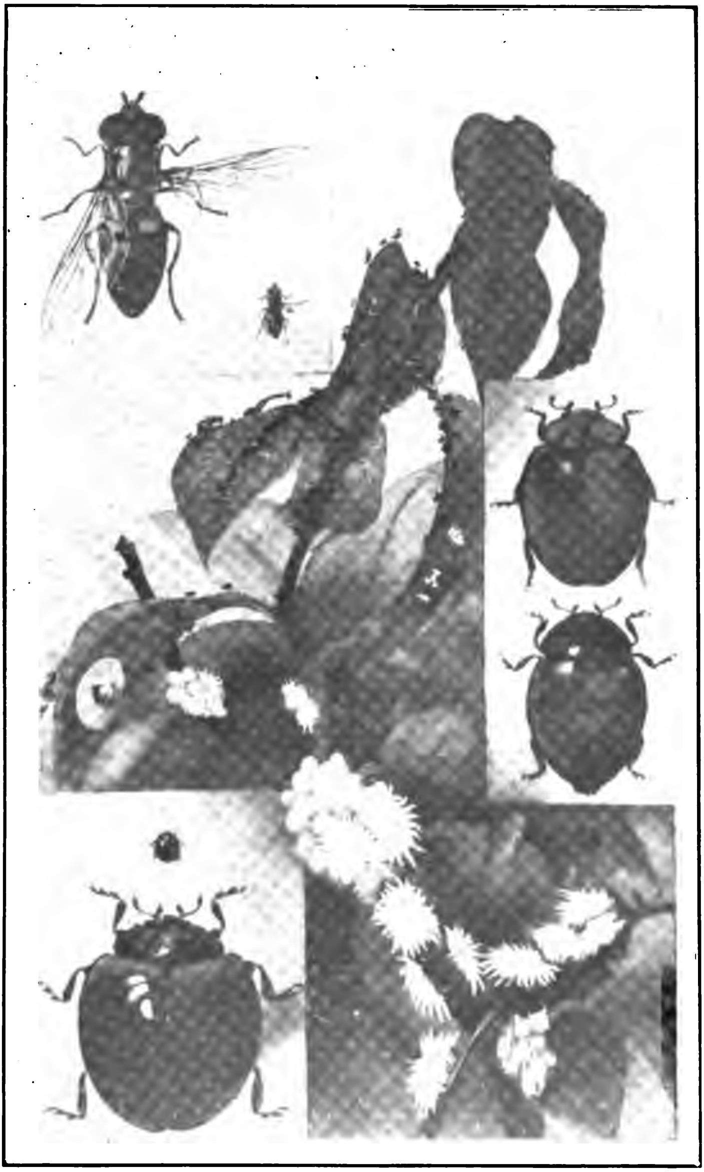


Plate 17. **Natural enemies of Citrus mealy bugs and Aphids.**
Infested twigs showing eggs, larvae and pupae of **Coelophora inequalis** and larvae of **Cryptolaemus montrouzieri** and **Xanthograunna graudicornis** feeding on mealy bugs and Aphis.

Upper left hand corner Syrphid fly (**Xanthograunna graudicornis**) natural size and much enlarged.

At right of center ladybird beetles, upper **Platyomus lividigaster,** lower **Cryptolaemus montrouzieri,** much enlarged.

Lower left hand corner, lady bird beetle **Coelophora inequalis,** natural size and much enlarged.

to control the pest when it has spread over the field and when the plants have obtained considerable growth. Not so however if methods of destruction were begun upon its first appearance in the field when the young plants have but little growth and foliage. Spraying at this time will generally save the plants and allow them to grow strong enough to withstand the later broods.

The *Orange Aphis* (*Mysus citricidus*) is another pest which has caused some inquiry, and has annoyed the grower. This pest however is not generally serious enough to cause alarm, only the growth of the young trees would be checked by the attack. Our numerous predaceous insects feeding on this species very soon check their numbers. Truck crops are of course constantly troubled by Aphids and it is generally the small grower or individual who has his patch of vegetables who really notices the damage more than the one who has large acres to handle. Spraying with soap solutions when the plants are small will tend to relieve the situation.

Ants.

We have three common ants which have given much trouble to the householder, and our assistance has been demanded quite frequently. The common black ant (*Pheidole megacephala*) is more of a garden pest, but frequently invades houses in search of food. The small dark house ant (*Monomorium floricola*) and the small yellow ant (*Monomorium pharaonis*) are both usually found in the pantry or wherever food is stored. These ants are not injurious to plants although many think so. When ants are crawling up into the plant or tree, they are in search of a colony of mealy bugs or plant lice to gather from them the honey dew, the sweet liquid which they exude. Ants frequently loosen the soil around young plants especially near the base and cause them to fall over. The black ant particularly has become very numerous, especially in dry situations, and has caused considerable annoyance to the housekeeper.

Fighting ants in the house may be done in two ways, first, by protecting food material from their attack. This can be done by the use of dishes containing water into which the legs of tables, ice-chests and cupboards may be placed, or tying bands, which are soaked with ant poison, around the legs of tables and other furniture. A very important step is to keep the premises clean and not allow bread crumbs, bits of meat or other particles of food to remain on the floor or table, which will constantly attract the ants. Second, and probably more satisfactory in the end is to endeavor to kill off the colony after finding the nest. Trapping ants with sponges moistened with either sweetened water or diluted bouillon and placed where ants swarm gives good results. After the sponges are covered with ants they can be picked up and dropped into boiling water and cleaned and the process repeated; in a short time the colony has been so reduced as to give very little trouble for a time being. The nests of the black ant are found outside the building in the ground and the inhabitants can be killed by the use of gasoline or carbon bisulphide. As both of these substances are explosive in the presence of fire, care should be exercised not to use matches or allow smoking when applying them. When the nest is found make three to six holes with a pointed cane or iron rod about ten inches deep and into each put about one ounce of either liquid and then close each hole with some loose earth. This might have to be repeated if the queens have not been killed. The nests of the other house ants are usually behind the baseboards or between the sills and the foundation; sometimes they build between the paper and wooden partitions. A liberal application of either gasoline or kerosene when the nest is found will very often kill off the colony.

White Ants. (Termites).

The white ants or termites are not very often seen by the occasional observer. They live in colonies and do serious injury to the wooden structure of buildings in which they work unmolested and unobserved. They tunnel in the timbers near the ground at first and gradually work their way into the upper structure. of buildings in which they work unmolested and unobserved. They tunnel in the timbers near the ground at first and gradually work their way into the upper structure. One species (*Coptotermes*) has proven very destructive on this Island. This species from all accounts has been in the Territory for many years and was probably brought in here from the Orient or Australasia. In June, 1912, we found a colony in the piling at the very end of Pier No. 7, and through our advice the harbormaster at that time succeeded in killing out that colony by using a mixture of equal parts of crude oil and kerosene which was poured into holes bored into the piles. Since then this pest has been reported from the Kamehameha Schools, the Capitol grounds and is now found on several wharfs of Honolulu. When the pest once takes hold of any structure it requires immediate action to stem its destructive work. All infested timbers should be removed and replaced with new ones which have been treated with creosote, crude oil or various other timber preservatives. The pest lives underground, and when a building has a stone foundation it will build mud runways from the ground over the stone to the wood work above it. I am afraid that this pest will prove a serious menace to many wooden structures in Honolulu. It will mean that concrete foundations will have to be used and the open spaces under buildings be made more accessible so as to facilitate frequent inspection. Infested timbers should be carefully removed and immediately burned to avoid carrying the pest to other localities, and the place must be thoroughly treated with creosote, kerosene or other penetrating liquids so as to kill all remaining individuals which have crawled out of the destroyed timber.

PINEAPPLE DISEASE.

A very peculiar disease of the pineapple made its appearance on pineapples in some of the fields on the Island of Kauai early in the year of 1913. The Commissioners of the Board of Agriculture and Forestry took immediate steps and passed Rule XVIII on May 24th of that year for the purpose of preventing the disease from spreading from the Island of Kauai to any other of the Islands. Nothing definite is known of the cause of the disease, and no organism has as yet been detected which would throw any light on the subject.

In June, 1914, the same disease made its appearance in a pineapple field on the windward side of Oahu. The Board of Commissioners immediately amended Rule XVIII so as to include the island of Oahu. The disease appears more abundant during the early summer months, May and June. Investigations are being carried on by Dr. H. L. Lyon of the Hawaiian Sugar Planters' Experiment Station, and it is to be hoped that during the coming season a definite cause for the disease will be brought to light. The following is Rule XVIII as amended:

Rule XVIII.

Rule and Regulation of the Board of Commissioners of Agriculture and Forestry concerning the control of Fungus Diseases on Pineapples.

The Board of Commissioners of Agriculture and Forestry of the Territory of Hawaii hereby makes the following rule and regulation for the purpose of preventing the spread of a fungus disease upon pineapples which has made its appearance upon the Islands of Kauai and Oahu.

SECTION I. All persons and corporations are hereby prohibited from carrying, transporting or shipping from the Islands of Kauai and Oahu to any other Island in this Territory any pineapple fruit, pineapple plant or pineapple sucker.

SECTION II. No pineapple fruit, pineapple plant or pineapple sucker shipped from any port of the Islands of Kauai or Oahu to any other port in this Territory shall be allowed to be landed. Inspectors and other duly appointed agents of the Board of Agriculture and Forestry are hereby empowered to examine and inspect all freight, baggage and belongings arriving at any port of the Territory from the Islands of Kauai and Oahu and to destroy any and all pineapple fruits, plants or suckers found among such freight, baggage or belongings.

SECTION III. Any person violating the above Rule shall be

guilty of a misdemeanor and upon conviction thereof shall be punished by a fine not to exceed Five Hundred ($500.00) Dollars as provided by Section 390 of the Revised Laws as amended by Act 82 of the Session Laws of 1905, and Act 112 of the Session Laws of 1907.

SECTION IV. This rule shall take effect upon its approval by the Governor.

Approved:

LUCIUS E. PINKHAM,
Governor of Hawaii.

Honolulu, Territory of Hawaii,
June 30, 1914.

RECOMMENDATIONS.

Now that the Panama Canal is open for traffic and owing to the noticeable increase of all classes of shipping, I would recommend that an adequate sum be appropriated so as to safeguard the Plant Quarantine inspection work. The Islands are now in direct communication with Central America, where very serious pests are known to exist. We should be well prepared to handle any and all shipments, whether destined to these islands or whether only in transit. Honolulu being a port of call will mean that many steamers will remain one, two or more days in port, and if any cargo in transit needs our supervision while in port, we should be able to meet the situation by having sufficient men to carry out our work.

Owing to the constant complaint from our citizens regarding the loss and annoyance of the Japanese Rose Beetle, Pink Cotton Boll Worm, the Melon Fly, the Alligator Pear Mealy Bug and the Corn Leaf Hopper, I would recommend that some action be taken by the Board of Commissioners to ask the incoming legislature to provide liberal funds for the search of natural enemies for the above pests. Since the successful introduction of several parasites for the Mediterranean fruit fly has been possible, the growers of crops injured by the above named pests are deeply interested and are anxious that something be done on similar lines to relieve their situation and if possible spare them their annual loss.

Respectfully submitted,

EDWARD M. EHRHORN.

Superintendent of Entomology.

DIVISION OF ENTOMOLOGY

REPORT OF THE WORK OF THE INSECTARY

Honolulu, Hawaii, December 31, 1914.

To the Superintendent of Entomology,
Board of Commissioners of Agriculture and Forestry,
Honolulu, T. H.

Sir:

I submit herewith a report on the operations of the insectary during the biennial period ending December 31, 1914. Before proceeding to the detailed account of the work I wish to refer briefly to the circumstances which led to the establishment of the insectary. You will recall that at the close of 1912 the Board was conducting a campaign against the fruit fly in which dependence for its control in and about Honolulu was placed on the destruction of wormy fruit and the poisoning of adult flies. Although the work was done with great thoroughness and had the sanction both of reason and experience, the results obtained were entirely disappointing, and it was felt that sooner or later it would have to be abandoned. About this time the President and the Executive Officer of the Board, Mr. W. M. Giffard, decided to attempt the introduction of parasites, and while casting about to see what could be done in this way, was fortunate enough to get into communication with a man who already had considerable experience with fruit flies and their natural enemies, namely, Prof. Filippo Silvestri of Naples, Italy. After considerable correspondence and exchange of views on the subject Prof. Silvestri was engaged to make a search for fruit fly parasites in tropical West Africa, this region being selected for exploration first because the bulk of the species of *Ceratitis* are found there. Prof. Silvestri left Naples in July of 1913, visited and investigated practically every colony along the West coast of Africa from Senegal to the Cape, finding evidence of abundant parasitism of fruit flies; and after seven months in the field came to Honolulu *via* Australia with living specimens of three larval and two pupal parasites and information in regard to nine other larval and three other pupal parasites, some of which he attempted to bring with him but lost *en route*. A full account of Silvestri's travels and observations is found in Entomological Bulletin No. 3 of this Board. It was in preparation for Prof. Silvestri's arrival and to take care of his parasite material that the insectary was built and equipped, and while little was known regarding the requirements of the work previous to his arrival the insectary proved entirely adequate and gave the greatest facility to the work of multiplying the parasites, which it was necessary to do before it could be expected to liberate them out-of-doors.

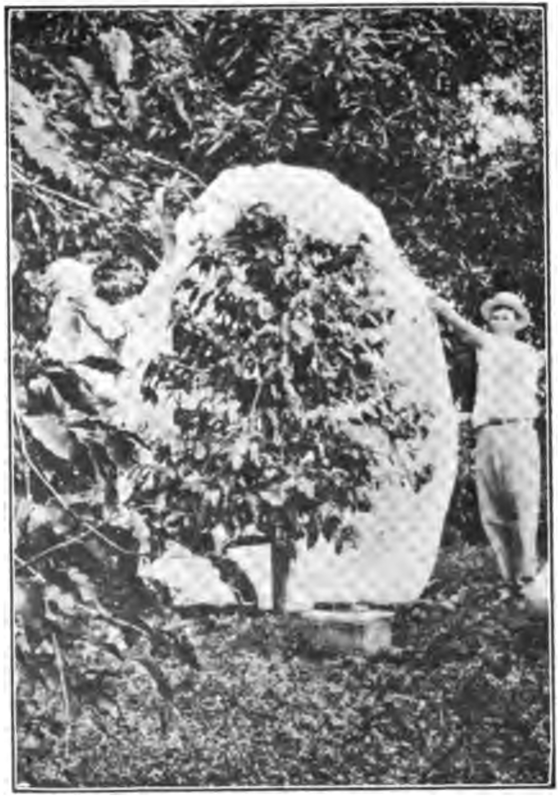
The two classes of parasites, larval and pupal, one laying their eggs in the worm through the skin of the fruit, the other in exposed pupae, required somewhat different handling. The host material of the latter was prepared by laying infested fruit on sand and sifting out the pupae. The former were placed inside cages with the wormy fruit itself.

The larval parasites, owing to the small numbers we had to work with and our inexperience in the matter of cages, slowly dwindled instead of multiplying and were finally lost altogether in the insectary, but not before a few individuals of the South African and Australian species had been liberated under tents in the coffee fields of Kona. This "log shot" on the establishment of the species, as will appear later, was a most fortunate move.

The pupal parasites, on the other hand, propagated well from the start and in a short time were being produced in thousands. The aim of the work in the insectary was to increase the number of parasites as rapidly as possible so as to be able to liberate large colonies in favored places on the different islands, which could by sheer force of numbers overcome the element of chance and bring about a quick and widespread establishment; and the criterion of this fact was to be the recovery of the species in nature.

As already stated, the work with the larval parasites came to an end abruptly when there were no more females to propagate the species, but not so with the pupal parasites; and in carrying out the original intention to continue multiplying and distributing the parasites until they were recovered outside, these two species were produced in enormous numbers, 73,639 by the end of 1913, when the breeding work was slackened down to a minimum; and they are still being produced in small numbers as neither species has yet been recovered in nature. I cannot at present think otherwise than that these species have really become established, but owing to the difficulties in the way of testing the question we may have to wait some time until chance brings us the proof.

No attempt was made to recover the larval parasites until October of that year when some infested coffee berries were sent to the insectary by the Board's agent in Kona. To the astonishment of everyone this material yielded a large number of the South African species. These were multiplied in the insectary without further trouble, and good sized colonies were later distributed to every fruit growing section in the Islands.



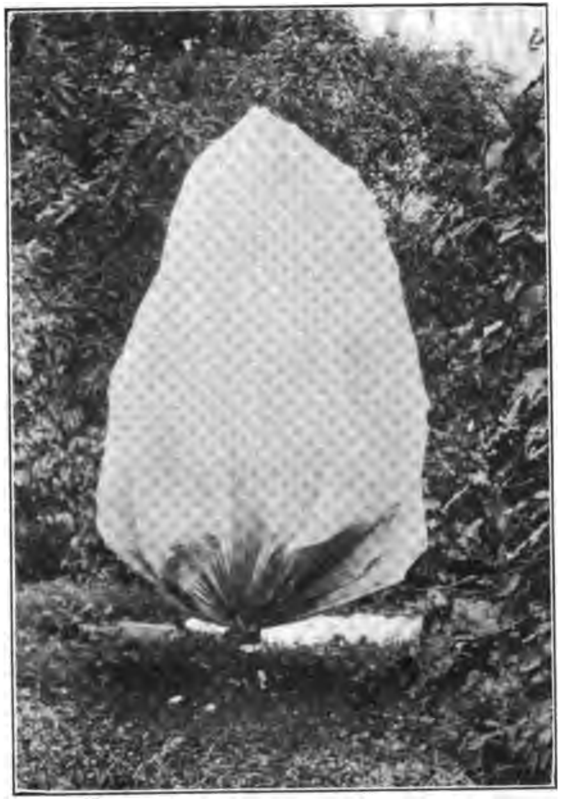


Plate 18. **Method of liberating larval parasites of the fruit fly.**

Fig. 1. **Adjusting Tent.**

Fig. 2. **Tent in place with parasites confined.**

Some other parasites and predators have also been handled in the insectary. A Dung Fly parasite (*Muscidifurax vorax*), brought by Prof. Silvestri from South Africa, has been produced by the thousands (76,279 at the close of 1913), and liberated in stables about Honolulu and on all the large cattle ranches on the Island. Two other Dung fly parasites (*Pteromalus sp.* and *Spalangia sp.*) brought by the writer from the Philippine Islands in the early part of 1914, were multiplied in large numbers and distributed in similar places, and a coccinellid beetle (*Scynnus bipunctatus*) feeding on mealy bugs was brought at the same time and liberated at various places around Honolulu. Later on, through an arrangement made with Prof. Silvestri, some work was undertaken on Horn Fly enemies in North Africa, and as a result of this the insectary was in receipt during the six months from January to July of various consignments of *Staphylinid* beetles, which are predatory on Dung Fly larvae and pupae. These beetles came mostly in very poor shape but all that were in a living condition were liberated in cow pastures where the conditions were suitable for their propagation.

I have recently had tables prepared to indicate the extent of the distribution of the different fruit fly and dung fly parasites, and an examination of these tables shows that good sized colonies of the parasites have been liberated in the following places:

FRUIT FLY PARASITES.

Hawaii
Kealakekua
Onouli
Honaunau
Keopu
Kiilae
Kealia
Holualoa
Kahaluu
Kaumalumalu
Kailua
Waiaha
Kainaliu
Keauhou
Kohala
Waimea
Hilo
Wainaku
Kahaiau
Paauilo
Honokaa
Pahala
Naalehu

Oahu
Honolulu
Waikakalaua
Waianae
Waiahole
Kualoa
Maunawili
Hauula
Pearl City

Kauai

Waimea
Lihue
Hanalei
Wahiawa
Koloa
Lawai
Kalakeo
Kealia

Maui
Lahaina
Honolua
Kahilipali
Wailuku
Makawao
Haiku

Molokai

E. Molokai (Meyers)
W. Molokai (Hitchcock's) (Conradt's)
Mapulehu Gulch

HORN FLY PARASITES.

Hawaii
Kamuela
Puna (Shipman's)
Kau (Monsarrat's)
Pahala
Naalehu
Kona (Geenwell's)
(Paris')
Puuhi
Puuwaawaa
Hilo
Kohala
Kukaiau
Olaa

Kauai
Waimea
Lihue

Oahu
Honolulu
Niu
Honouliuli
Kunea
Kawailoa
Waialae
Waimea
Kahuku
Mokuleia
Kualoa
Waianae
Koko Head
Robinson Station
Hauula
Maunawili

Lanai
Keomoku

Maui
Pohakupule
Makawao
Paia
Waiohula
Ulupalakua
Kahikinui

Molokai
Pukoo
Kamalo
Koluaha
Mapulehu
Kaunakakai
Kalaupapa

The promising nature of the field developed by Silvestri led the Board to dispatch a second expedition to West Africa which left in June of last year. The writer and J. C. Bridwell went out this time, Prof. Silvestri being unable to obtain a leave of absence from the government school where he is employed. The main object of the second expedition was to get as many as possible of the parasites observed by Silvestri on the previous excursion and any others which might be discovered by us. The expedition started out under most favorable circumstances, as we knew exactly what was wanted, how to get it, and in a large measure how to handle the parasites when secured. It was also possible by making personal representations to the American Government at Washington and to the British Government at London, to get first class credentials, which are so necessary in travelling abroad and especially in West African colonies. The British Colonial office also recommended us to the Governors of all the British colonies along the West Coast for such assistance as it was within their ability to give, and we were able to make excellent financial arrangements through the office of the Bank of British West Africa in London. Most of the equipment was secured in London at reduced rates from the Army and Navy Stores. We sailed from Liverpool on the 8th of July, touching at Teneriffe, Canary Islands, on the 14th; Freetown in Sierra Leone on the 19th; and arrived at Lagos, Nigeria, July 24th. As information obtained from Silvestri made it extremely doubtful whether we could secure a colony of the Mediterranean fruit fly in Nigeria a good supply was obtained in Teneriffe and taken with us. On arrival at Lagos we went immediately to the office of the Colonial Secretary, who promised us all the assistance the Government could give, and wired immediately to the Director of the Forestry Station at Olokemeji to place the facilities of the station at our disposal. The following two days were spent investigating fruit conditions around Lagos. Only cultivated fruits were observed and these were scarce. Most of the fruits were green, but we found a few ripe mangoes and some pitanga cherries which yielded the Mediterranean fruit flies in small numbers. A single specimen of an undetermined *Opius* was captured alive by Mr. Bridwell in the Experimental Gardens at Ebute-Metta. On the morning of July 27 we took the train from Lagos for Olokemeji, about one hundred miles inland, arriving in the afternoon and were met at the station by Mr. R. E. Dennett, acting director, who installed us temporarily in the residence of the director and later gave us an unoccupied house on a neighboring hill in the midst of the native forests, to use as a residence and laboratory. By the 29th we were settled down to work. From this date to the 17th of August our time was spent in making daily searches through the forests and fields in the neighborhood of Olokemeji for fruit infested with fruit fly maggots, and collecting and studying as far as possible the hymenopterous parasites of that region. We were unable to find all the cultivated fruits in the forestry station grounds referred to by Prof. Silvestri, but daily ran across some new and unfamiliar fruit in the forests, some of which contained maggots. In open and neglected places overgrown with weeds and in a few abandoned fields we found one fruit very abundant—a small cucurbit of the genus Momordica which contained trypetid larvae, and on the Saturday after our arrival I observed and captured a few individuals of the small chalcid parasite described by Prof. Silvestri as *Tetrastichus giffardi*, on fruit of this cucurbit. As this parasite was considered by Silvestri to be one of the most efficient checks on the multiplication of fruit flies in Africa, and as we had been especially commissioned to get it on this occasion, I immediately set to work to gather all the fruits of this plant that I could find, and inside of a week had several thousand pupae out of them. It is a peculiarity of the parasite referred to that the later stages of its development can be observed through the skin of the host, and our delight was boundless when at the expiration of ten days we could see that a large proportion of the pupae we had collected were parasitized. By the 15th of the month we had several thousand additional pupae, and as we had planned on comming out to colonize this parasite in the Canaries in the fall and send it by mail to Honolulu through the winter, I immediately made plans to leave for the Canary Islands. Such equipment as was needed was hastily got together and packed along with all the parasitic material that could be obtained, and on the morning of the 18th I took the train for Lagos, sailing the following day on the S. S.

Abosso for Teneriffe. On the second day out the parasites began to emerge from the older material and continued to come out for ten days or more. Somewhat to my surprise the material produced in addition to *Tetrastichus* two Braconid species, quite readily distinguished by their color, one being black, the other a brownish yellow. The latter was afterwards determined to be *Diachasma fullawayi,* a species discovered by Prof. Silvestri on the previous trip; the black species is possibly new. I had, then, as a result of the few weeks spent in Nigeria, *Tetrastichus,* three *Opius* forms (counting the individual taken alive by Bridwell in Ebute-Metta) and a few individuals of a *Spalangia* found in working over the infested fruits of the Momordica. These parasites were kept alive in glass tubes stoppered with cotton by feeding them honey placed in small drops on the leaves of an evergreen shrub which was carried along with me. On the morning of the 24th we touched at Freetown, Sierra Leone, and I was here obliged to leave the ship and go ashore, as cable orders had been received from the British Admiralty directing the ship to proceed at once to Liverpool for trooping, without calling at Teneriffe. The next day, however, a freighter appeared which would call at Teneriffe, and I embarked that afternoon on the S. S. Eboe, the vessel sailing the following morning. The passage from Sierra Leone to Teneriffe, which is ordinarily made in six days, was now lengthened out to twelve, as our carrier, being a freighter, was obliged to call at Conakry, Dakar and Bathurst for cargo on the way up. But this delay while it caused me a great deal of anxiety on account of the possibility of the parasites dying *en route,* gave me time to conduct some experiments with *Tetrastichus* in the Mediterranean fruit fly, which I had been breeding in storage apples since our arrival at Olokemeji. Before reaching Teneriffe, therefore, I was able to determine (1) that *Tetrastichus giffardi* was a larval parasite, ovipositing in worms half to full grown, (2) that it would parasitize the Mediterranean fruit fly; and (3) that it was a primary parasite, since it bred in *Ceratitis capitata* in pure culture; besides getting a new lot of parasites from individuals used in the experiment.

We arrived in Teneriffe the morning of September 5th, and after unpacking my equipment and arranging a temporary laboratory at the hotel, I went to the fruit markets to see if suitable fruits could be obtained for the propagation of the parasites. Fruit was very abundant in the markets, but peaches were the only kind that was heavily infested and suitable for the work. I began the multiplication of the parasites at once, and in three weeks had accumulated a large amount of material.

I had planned on leaving Bridwell to remain in Teneriffe until he should join me in November, but information received

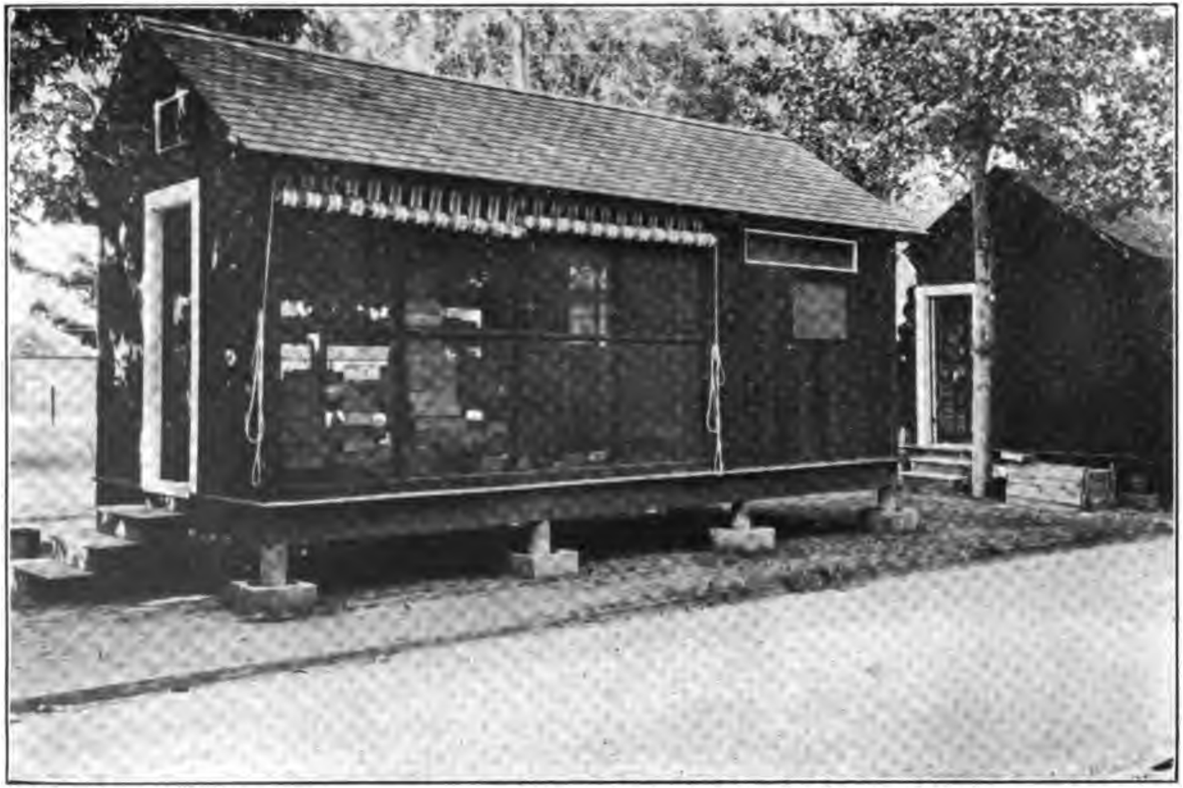


Plate 19. Insectary used for the propagation of introduced parasites.

from the American Consul in regard to the low temperatures during the fall and winter months and the interruption in the steamship service due to the war led me to abandon these plans, and as soon as I had ascertained that the parasites were developing in the Teneriffe material I decided to strike out for home. After notifying Bridwell of the change of plans I took a French steamer, the Mexican, on the 27th of September for Havana, Cuba, reaching that port on the morning of the 15th of October. From Havana I took a steamer for Key West, Florida, and came thence by train through Jacksonville, Montgomery and New Orleans to San Francisco, arriving in time to take the S. S. Wilhelmina for Honolulu, where I landed on the 27th of October with the following:

300	male and female *Tetrastichus giffardi,*
12	female and 19 male *Diachasma fullawayi,*
4	female and 22 male *Opius,* species undetermined,
10	female and 2 male *Spalangia,* species undetermined;

also some parasitized pupae bred *en route*. Mr. Ehrhorn, being advised of my coming by wireless, had collected a large supply of infested fruits. On the morning following my arrival I began multiplying the parasites in order to get large numbers for liberation, and this work has been going on continuously ever since. Mr. Bridwell is still in the field and is expected home sometime in March. His orders were to remain at Olokemeji for at least three months, to pay particular attention to the Braconid parasites of the fruit flies, and to make every possible endeavor to discover egg parasites. At last report he was in South Africa multiplying the parasites secured in Nigeria and investigating the South African field.

Of the four species brought to Honolulu by myself one—the black *Opius*—produced only males in the first generation and was lost to us unless it is among the species which Bridwell has. The others have multiplied satisfactorily, 419 females and about 1000 males of *Diachasma fullawayi*, 21,431 *Tetrastichus* and 7 *Spalangia* having been produced at the time of this writing. Liberations have been made as follows:

TETRASTICHUS GIFFARDI

Oahu		
Nuuanu	12,300	
Manoa	950	
Moanalua	1,000	
Pearl City	200	14,450
Hawaii		
Kona	1,800	
Hilo	1,000	2,800
Kauai		
Lihue	800	800
Total		18,050

DIACHASMA FULLAWAYI

Oahu		
Maunawili	35	
Hawaii		
Kona	160	195
Total		195

The present purpose is to continue multiplying these parasites similarly to the others, until we can ascertain that they are established in nature. In August of 1914 the Australian Opius (*Diachasma tryoni*) which was liberated in Kona at the same time as the South African species, was also recovered and is now known to be well established all through the coffee fields of that district. We are endeavoring to multiply it in the insectary from specimens brought from Kona by Dr. Back, in order to establish it on Oahu and eventually on all of the other Islands.

The great reduction of flies which has been brought about by the parasitism of these species is already being noticed by even the casual observer. The depletion in numbers is naturally much more marked in Kona, where the fly had unusual opportunities to increase before the introduction and establishment of the parasites. Dr. Back, on a recent visit to Kona, was so impressed by the altered condition that he set to work to secure data on the extent of the parasitism, both in Kona and in Honolulu, and I am indebted to him for the opportunity of presenting the appended table showing the percentages of parasitism in the two districts, in different fruits and in large and small quantities of each fruit. It will be noticed that some of the lots produced as high as 50 per cent of parasitism from one species, though the average out of all kinds of fruit is only about 15 per cent. In Kona the parasitism is even somewhat higher.

It is particularly gratifying to those who planned and carried out this work to see the present measure of achievement come so soon, and it is earnestly hoped that the Board will see the usefulness of this line of work in connection with the Entomological Division and make every effort to have it continued.

The principal participants in the work have already been mentioned, but it would be unfair to pass without notice the contributions of a number of men throughout the Territory who have helped materially in getting results. The most active of these were Messrs. J. P. Curts and Robert Wallace of Kona, Hawaii, Mr. John Herd of Maunawili Ranch, Oahu, and Mr. Frederick Meyer of Waianae, Oahu. There are also many others who cannot be mentioned by name, but to all we wish to make grateful acknowledgment.

Respectfully submitted,

D. T. FULLAWAY,

Field Entomologist.

Parasitism Among the Larvae of the Mediterranean Fruit Fly (*C. Capitata*) in Hawaii During 1914

BY

E. A. Back and C. E. Pemberton,
Bureau of Entomology,
United States Department of Agriculture.

W. M. Giffard, Esq.,
President and Executive Officer,
Board of Agriculture and Forestry,
Honolulu, T. H.

Sir:

It will be recalled that at the time the Federal Bureau of Entomology began its investigation of the Mediterranean Fruit Fly (*Ceratitis capitata*) in the Hawaiian Islands in August, 1912, you made the request of Mr. C. L. Marlatt, Assistant Chief of the Bureau of Entomology, and entomologist directly in charge of this investigation, that the Bureau leave to your Board the problem of finding, introducing and establishing parasites of this pest in Hawaii, inasmuch as your Board had already engaged the services of Dr. F. Silvestri for this purpose. The writers have, therefore, confined their efforts to other phases of investigational work, and such information as they have secured has been obtained quite incidentally to their other work. They have, however, been forced recently to take an added interest in the parasites introduced and established by the very frequent occurrence of parasites among the fruit flies used in their experimental work, and in the marked decrease of the pest in certain districts with the resulting effect upon the degree of infestation of host flies.

This active interest began during July, 1914, when the writers were confronted in their biological work with a parasitism ranging from 29 per cent to 53.8 per cent among certain pupae derived from strawberry guavas (*Psidium cattleyanum*). Since that time it has been the custom of the writers to take from lots of pupae obtained for experimental purposes, samples which were placed in covered jars. These samples were allowed to remain in their containers until all emergence had ceased, when they were emptied separately into large pill boxes, properly labelled, and set aside until such time as the laboratory force could make the counts necessary to determine the percentages of parasitism. Since the few examinations that were made during July indicated that the average parasitism did not exceed 3 per cent, the percentages just determined are a pleasant surprise, and are here presented, at your request, and with the approval of the Federal Bureau. While it is too early yet to predict that the Mediterranean Fruit Fly will be satisfactorily controlled by introduced parasites, there can be no question but that the South African parasite, *Opius humilis*, alone, is partially, if not entirely, responsible for the noticeable decrease in fruit fly abundance in certain localities, and that the moneys appropriated by your Board for parasitic work have already yielded most gratifying results.

In presenting these data on parasites it should be mentioned that all have been obtained from material gathered within the limits of Honolulu with the exception of those resulting from an investigation of the fruit fly in coffee in the Kona District during October and November. Aside from the comparatively few specimens of the Australian parasite, *Diachasma tryoni*, bred from the Kona material no introduced parasite has been bred but the South African, *Opius humilis*. As no specimens of this latter species were liberated on the Island of Oahu previous to November and December, 1913, the Honolulu data form a distinct addition to our knowledge of the multiplication of this parasite during the first year after its liberation, and will play an important part in determining the increase in its efficiency during coming years.

Before introducing the percentages to which reference has been made, the writers wish to bring out two additional points: first, that during the year and a half previous to the liberation of introduced parasites in Honolulu, and previous to the liberation of these parasites at any other points in the Islands where federal work had been carried on, the writers had at no time bred *Opius* or *Diachasma*, whereas at the time of this writing (December, 1914) parasites are bred from practically every lot of fruit flies brought to the laboratory from localities where parasites have been liberated; second, that complete justice is not done the parasites in every instance recorded in Tables II to V. This is due to the fact that both *Opius humilis* and *Diachasma tryoni* parasitize only, or for the most part, the medium sized or well grown larvae of the fruit fly. Thus if any lot of fruit be placed in a container and allowed to remain until all larvae have emerged and pupated, the percentage of parasitism obtained from the total number of pupae secured is less than would have been the case had the fruit been left to ripen on the tree and fall normally, thus giving the parasites opportunity to attack as they developed those larvae that were too small for them at the time the fruit was gathered. The writers secured larvae at the insectary as they emerged from the fruits daily. It is evident, therefore, that, as larvae do not generally emerge from fruits until they are full grown, the last larvae to be secured from any lot of fruit would show no parasitism, or a parasitism very much less than would the larvae emerging during the first few days after the gathering of the fruit. This point is made clear by the data in Table I, secured from larvae emerging from coffee cherries picked in Kona, Hawaii.

TABLE I. Parasitism among larvae developing in coffee grown in Kona, Hawaii.

Coffee grown at	Date of collection of sample	Larvae emerged between	Percentage of larvae parasitised by		Total percentage of parasitism
			Opius humilis	*D. tryoni*	
Kahului	Oct. 31	Oct. 31—Nov. 3	31.2	21.8	53.0
		Nov. 3—Nov. 6	20.	12.3	32.3
		Nov. 6—Nov. 9	5.3	.7	6.0
		Nov. 9—Nov. 11	0.0	.0	0.0
Hookena	Oct. 31	Oct. 31—Nov. 3	16.7	40.7	57.4
		Nov. 3—Nov. 6	17.0	19.0	36.0
		Nov. 6—Nov. 9	1.2	0.0	1.2
		Nov. 9—Nov. 11	0.0	0.0	0.0
Kahaloa	Oct. 30	Oct. 30—Nov. 8	80.4	2.2	82 6
		Nov. 3—Nov. 6	23.3	0.4	23.7
		Nov. 6—Nov. 9	3.7	0.0	3.7
		Nov. 9—Nov. 11	0.0	0.0	0.0
Keauhou	Oct. 30	Oct. 30—Nov. 3	85.2	0.0	85 2
		Nov. 3—Nov. 7	55.2	0.0	55.2
		Nov. 7—Nov. 9	6.7	0.0	6.7
		Nov. 9—Nov. 11	3.7	0.0	3.7

The data in Table I leave no doubt that only those percentages of parasitism secured from larvae emerging soon after the fruit is gathered represent the real effectiveness of the parasites for any particular lot of fruit. And it is because this fact was not fully appreciated by the writers until the above data were secured that they are not able to state definitely that each percentage recorded in Tables II.-V. is based upon the first lot of larvae secured from each lot of fruit. Often samples of fruit were taken at frequent intervals from the same locality, hence elimination of all but first emergence records has been difficult. It can be stated, however, that all negative results recorded in these tables are first emergence records. In the main the percentages in Tables II.-V. are believed to contain very few but first emergence records and fairly represent the control exerted by *Opius humilis* in Honolulu during the months covered. There has been found a wide range in parasitism even among larvae first emerging from the fruit taken at different times from the same tree, thus proving that no percentage, no matter how high or how low, can be taken as representative of any particular locality.

Percentages of parasitism have not been secured for larvae emerging from all host fruits. Parasites have been bred from larvae developing in the ball kamani (*Callophyllum inophyllum*), the Carambola (*Averrhoa carambola*), the Chinese orange (*Citrus japonica*), coffee (*Coffea arabica*), Eugenia (*Eugenia michelii*), mangoes (*Mangifera indica*), *Mimusops elengi*, Natal plum (*Bunchosia sp.*) *Ochrosia*, the peach (*Amygdalus persica*), the rose apple (*Eugenia jambosa*), the strawberry guava (*Psidium cattleyanum*), the Bestill (*Thevetia neriifolia*), and the winged kamani (*Terminalia catappa*). Only the percentages secured from larvae developing in coffee, chinese oranges, strawberry guavas, bestills and winged kamanis have been tabulated (see Tables I.V.). Other data are given below:

Ball kamani. One hundred and three larvae emerging from samples of fruit gathered on August 15 in Nuuanu Cemetery showed a parasitism of 1.1 per cent.

Carambola. Larvae emerging during late September from fruit gathered at 1516 Beretania St., Punahou Street, Maguire and Spencer Streets, and 1008 Kapiolani St. showed a parasitism of 45.4, 6.2, 75 and 12.5 per cent respectively.

Coffee. The percentages given in Table I. show that parasitism in Kona is very high. Larvae emerging from coffee cherries gathered about the middle of November at Lanihau, Kahaloa, Keei Mormon Church, and Kealakekua showed a parasitism of 97.8, 93.1, 83.4 and 76.6 per cent respectively. Samples of cherries collected on October 30 and 31 at Honalu, Honaunau, Lanihau, first Holualoa store, second Holualoa store, Kainaliu and Kalaua yielded larvae showing a parasitism of 84.6, 70.9, 70, 34, 59.8,75 and 66.7 per cent respectively. The percentages of parasitism among larvae in Kona coffee ran consistently high. This is due in all probability to the abundance of fruit fly larvae and coffee, and the ease with which the parasite can reach its host through the thin skin of the coffee cherry. Larvae emerging in Honolulu from cherries gathered during September from Judd and Liliha Streets (two samples); Maternity Home, Beretania St.; Booth Estate, Pauoa Road, and at 1972 Pauoa Road showed a parasitism of 39.5, 24.3, 3.9, 5.1 and 25.3 per cent respectively.

Eugenia. Two samples of fruit gathered at Victoria and Beretania Streets, during September yielded larvae showing a parasitism of 9.5 and 6.1 per cent respectively.

Mangoes. Seven lots of mangoes collected in Honolulu, locality unrecorded, during July and August yielded larvae showing a parasitism of 1.5, 3, 0, 7.1, 10.4, 0 and 0 per cent respectively.

Mimusops elengi. Over three hundred larvae emerging from two lots of this fruit gathered at Queen's Hospital during July yielded no parasites.

Natal Plum. Larvae emerging from one lot of this fruit gathered at Kalihi near Thomas' Pineapple Cannery showed a parasitism of 6.1 per cent.

Ochrosia. Larvae emerging from lots of this fruit gathered during August from Spreckels' Estate, Punahou St., and from the grounds of the Board of Agriculture and Forestry showed a parasitism of 29 per cent and 0 per cent respectively.

Peach. From 2,301 larvae emerging during July from peaches grown at Kaala Avenue and Vancouver Highway, no parasites developed.

Rose Apple. Fruit gathered from 9118 Pauoa Road and Pauoa Valley opposite church, yielded larvae showing a parasitism of 0 per cent and 40 per cent respectively.

TABLE II. Percentage of Parasitism among *C. capitata* larvae developing in Chinese oranges (*Citrus japonica*).

Date of Larval Emergence	Locality	Number of Specimens Bred		Percentage of Parasitism
		C. Capitata	O. Humilis	
August 3	Manoa Valley	27	2	13.80
" 5	" "	27	1	3.60
" 24	" "	50	1	2.00
" 28	" "	376	4	1.05
Sept. 2	Punahou Street	171	5	2.80
" 7	Beretania Street	41	3	6.80
" 8	Punahou Street	17	2	10.50
" 10	" "	22	3	12.10
" 11	Beretania Street	26	2	7.1
" 12	Punahou Street	26	32	55.20
" 16	1516 Beretania Street ...	43	3	6.50
" 17	Kapahula St.	15	2	11.60
" 18	Punahou Street	31	1	3.10
" 25	957 Prospect	6	0	.00
" 28	King and Alapai	23	1	4.17
" 29	957 Prospect	40	1	2.44
" 29	Punahou St.	17	2	10.50
" 30	957 Prospect	8	2	20.00

TABLE III. Percentage of Parasitism among *C. capitata* larvae developing in Strawberry Guavas. (*Psidium cattleyanum*).

Date of Larval Emergence	Locality	Number of Specimens Bred C. Capitata	O. Humilis	Percentage of Parasitism
July 16	Manoa Valley	156	0	.00
" 23	" "	362	0	.00
" 27	" "	288	92	29.00
" 30	" "	380	218	35.00
" 31	" "	244	287	53.86
Aug. 5	" "	953	183	16.11
" 7	" "	550	173	24.00
" 8	" "	1,341	200	12.98
" 11	" "	1,063	32	2.92
" 29	" "	48	12	20.00
" 29	Punahou St.	95	3	3.00
" 31	" "	300	1	.33
" 31	Dominis St.	232	6	2.52
Sept. 1	" "	99	0	.00
" 1	Punahou St.	101	4	3.81
" 2	Dominis St.	68	7	9.50
" 3	" "	21	3	12.50
" 3	Punahou Street	60	3	4.76
" 7	" "	18	1	5.26
" 8	King and Punahou Sts.	0	4	100.00
" 8	Beretania and Hotel	50	11	18.00
" 9	" and Punahou Sts.	40	4	9.10
" 11	1516 Beretania St.	6	1	14.30
" 11	King and Punahou	31	51	62.20
" 11	Beretania St.	98	2	2.00
" 12	" "	98	2	2.00
" 12	" "	62	75	54.70
" 12	Punahou St.	39	0	.00
" 14	Beretania St.	34	4	10.52
" 14	King and Punahou	154	86	36.00
" 15	1516 Beretania	233	57	19.50
" 15	Judd St.	11	1	8.30
" 15	Puunui St.	19	1	5.00
" 16	King and Punahou	35	57	62.00
" 16	King and Punahou Sts.	123	20	14.00
" 17	1516 Beretania St.	51	1	1.90
" 18	" "	17	2	10.50
" 19	Bates St.	22	1	4.30
" 19	Keeaumoku St.	40	2	4.00
" 19	Georgia St.	6	0	.00
" 22	130 Bates St.	43	6	12.29
" 22	1421 Piikoi St.	41	11	21.10
" 24	" "	13	1	7.10
" 25	" "	11	3	21.43
" 25	130 Bates St.	11	4	26.60
" 26	Kapiolani St.	96	2	2.00
" 28	1421 Piikoi St.	29	8	21.60
" 29	Kapiolani St.	39	1	2.50
" 30	King and Alapai St.	15	0	.00
" 30	Victoria and Beretania	8	0	.00

TABLE IV. Percentage of Parasitism among *C. Capitata* larvae developing in Bestills (*Thevetia neriifolia*).

Date of Larval Emergence		Locality	Number of Specimens Bred		Percentage of Parasitism
			C. Capitata	O. Humilis	
Aug.	12	Manoa Valley	123	4	3.15
"	24	Waikiki	250	3	1.19
"	28	Manoa Valley	304	0	.00
"	28	Pauoa Valley	99	21	17.50
Sept.	1	Manoa Valley	194	2	1.00
"	4	Moiliili	273	8	3.00
"	7	Manoa Valley	272	0	.00
"	7	Pawaa Jct.	82	0	.00
"	8	Artesian and Young	25	0	.00
"	11	Punahou St.	67	0	.00
"	11	Fort and Piikoi	114	1	.90
"	11	Pawaa Jct.	182	0	.00
"	11	Moiliili	92	5	5.10
"	12	Punahou St.	16	11	40.70
"	15	1315 Wilder Ave.	11	1	8.30
"	15	Piikoi and Wilder	49	2	3.90
"	15	Magazine and Spencer ..	7	18	72.00
"	15	Prospect St.	12	4	25.00
"	15	Pauoa Valley	38	1	2.60
"	15	2425 Nuuanu St.	125	2	1.57
"	15	2268 Nuuanu St.	61	0	.00
"	15	Lunalilo Home	42	10	19.20
"	15	2048 Nuuanu St.	15	0	.00
"	15	Queen's Hospital	4	6	60.00
"	16	Liliha St.	14	4	2.20
"	16	76 Judd St.	5	0	.00
"	16	Moiliili	65	13	16.60
"	16	Pawaa Jct.	13	0	.00
"	16	Queen's Hospital	91	10	9.90
"	17	Kawaiahao Cemetery ..	79	12	13.10
"	17	98 Kamehameha IV. Rd.	164	11	6.30
"	18	Kalakaua Ave. and King	5	4	44.40
"	18	Pawaa Jct.	17	0	.00
"	23	Ainahau and Kalakaua ..	4	6	60.00
"	26	" "	42	1	2.30
"	28	Maguire and Spencer Sts.	3	1	25.00
Oct.	7	Pauoa Church	24	0	.00
"	7	St. Mary's Mission	6	0	.00
"	7	Kewalo and Wilder Ave.	31	7	18.40
"	7	Fort and Vineyard Sts...	187	0	.00
"	7	Makiki Cemetery	56	0	.00
"	7	Iwilei	39	0	.00
"	7	1125 Lunalilo St.	36	3	7.70
"	7	Pawaa Jct.	26	9	25.00
"	7	1315 Wilder Ave.	28	3	9.80
"	7	1125 Lunalilo Street	46	18	28.10
"	7	1412 Gulick Ave.	13	8	66.10
"	7	2001 Beckley St.	20	6	23.10
"	7	Sing Loy Lane	89	8	9.20
"	7	Kawaiahao Cemetery ...	11	1	8.30
"	7	Makiki Cemetery	106	0	.00
"	7	Piikoi St.	28	0	.00

TABLE V. Percentage of Parasitism among *C. Capitata* larvae developing in Winged Kamani (*Terminalia catappa*).

Date of Larval Emergence	Locality	Number of Specimens Bred C. Capitata	O. Humilis	Percentage of Parasitism
Aug. 6	Pawaa Jct.	321	12	3.60
" 20	Waikiki	1,670	17	1.00
" 22	Pawaa Jct.	1,050	25	2.30
" 28	Punahou St. nr. Beretania	969	78	7.40
" 28	Pauoa Valley	144	9	5.80
Sept. 1	Punahou	1,202	71	5.57
" 2	"	683	43	5.93
" 2	Waikiki	1,134	4	.35
" 3	Pawaa Jct.	952	7	.72
" 3	Punahou St.	1,057	47	4.25
" 7	Piikoi St.	130	10	7.10
" 7	Beretania and Hotel St..	56	0	.00
" 7	Georgia St.	40	27	40.30
" 7	Puunui St.	803	97	10.80
" 8	"	239	34	12.40
" 8	Moana Hotel	56	4	6.60
" 9	Piikoi	57	2	3.40
" 8	Pawaa Jct.	129	1	.80
" 9	Waikiki	847	28	3.30
" 10	Pawaa Jct.	200	23	10.30
" 10	Moana Hotel	506	6	.98
" 10	Punahou College	126	14	10.00
" 11	Piikoi St.	166	42	20.20
" 11	Beretania and Punahou..	96	4	4.00
" 12	Moana Hotel	121	11	8.30
" 12	Pawaa Jct.	168	4	2.30
" 12	Queen's Hospital	93	11	10.10
" 12	Georgia St.	32	13	29.00
" 12	Punahou and Wilder	12	6	33.30
" 12	Richards St.	22	8	26.60
" 14	"	61	26	29.90
" 14	Queen's Hospital	30	8	21.10
" 14	Emma St.	7	7	50.00
" 14	Pawaa Jct.	124	7	5.40
" 14	Nuuanu Cemetery	31	15	32.61
" 14	Punahou St.	156	1	.64
" 15	Waikiki	400	0	.00
" 15	2425 Nuuanu St.	173	9	4.90
" 15	Puunui St.	74	2	2.60
" 15	Moana Hotel	250	0	.00
" 16	1516 Beretania St.	6	0	.00
" 16	Punahou College	48	3	5.90
" 16	Waikiki	110	1	.90
" 16	Nuuanu and Judd St.	62	4	6.10
" 16	Emma Street	60	3	4.70
" 16	Puunui St.	57	2	3.40
" 16	Asylum Lane	79	1	1.20
" 17	Moana Hotel	26	7	21.20
" 17	Pawaa Jct.	138	23	14.00
" 18	Georgia St.	12	2	14.30

Date of Larval Emergence	Locality	Number of Specimens Bred		Percentage of Parasitism
		C. Capitata	O. Humilis	
Sept. 19	2039 Nuuanu St.	125	7	5.30
" 19	Richards St	403	39	8.59
" 19	1649 Nuuanu St.	34	6	15.00
" 19	Wyllie St.	24	1	4.00
" 21	130 Bates St.	122	1	.80
" 21	1914 Nuuanu St.	54	0	.00
" 21	Nuuanu Cemetery	8	1	11.10
" 21	412 Ninth Ave.	304	31	9.25
" 22	" "	356	4	1.10
" 22	Georgia St.	40	0	.00
" 22	Emma St.	32	3	8.50
" 23	2527 Liliha St.	4	1	20.00
" 23	Ainahau Hotel	65	2	2.90
" 24	412 Ninth Avenue	21	8	27.60
" 24	Ainahau Hotel	9	5	35.70
" 24	Auld Lane	8	2	20.00
" 24	Richard Street	5	4	44.00
" 25	Piikoi and Lunalilo Sts.	12	74	86.00
" 25	Pawaa Jct.	19	2	9.50
" 25	Auld Lane	10	7	41.20
" 25	Wyllie St.	1	4	80.00
" 25	2039 Nuuanu St.	13	1	7.10
" 25	St. Louis College	14	3	17.60
" 26	2039 Nuuanu St.	11	1	8.30
" 26	Punahou near Beretania	42	16	27.60
" 26	1917 Luso Street	32	2	5.90
" 26	Piikoi and Lunalilo	14	85	85.80
" 28	957 Prospect St.	14	3	17.65
" 28	Ainahau Hotel	75	5	6.20
" 28	2425 Nuuanu St.	12	5	29.40
" 29	Wyllie St.	18	1	5.20
" 29	1519 Beretania St.	11	2	15.40
" 30	Beretania and Kapiolani.	10	1	9.10
" 30	Kapahúla and Alapai Sts.	71	1	1.40
" 30	Ainahau Hotel	9	2	19.10

Division of Animal Industry

LETTER OF SUBMITTAL.

Honolulu, Hawaii, December 31, 1914.

The Board of Commissioners of Agriculture and Forestry,
Honolulu, Hawaii.

Gentlemen:

I have the honor to submit herewith the report of the Division of Animal Industry for the biennial period ending December 31, 1914.

The period has been one of unprecedented prosperity for the live stock industry of the Territory, and as it practically brings to a close a decade of work, the Division of Animal Industry having been created by the Legislature of 1905, it may not be amiss here to review briefly the scope and character of the work and its results during these ten years.

STATUTORY FOUNDATION OF THE DIVISION.

Through the efforts of the Hawaii Live Stock Association, in conjunction with the then director of the Federal Experiment Station in Honolulu, the Hon. Jared Smith, the U. S. Bureau of Animal Industry was prevailed upon to station a veterinary inspector here for the purpose of investigating diseases of live stock with a view to devising means for their control, suppression and eradication; also to study live stock conditions in general and recommend measures for the further development of this important industry.

The present writer was selected for the position, arriving here on March 1, 1905, and immediately went to work on a survey of the live stock on the principal ranches and plantations throughout the Territory. It very soon became evident that without the support of a fundamental law upon which to base rules and regulations, and the establishment of a bureau or office for the enforcement of the same, all efforts to promote the industry must of necessity become abortive, the preliminary investigation having proven the extensive prevalence of a number of infectious and contagious disases among nearly all classes of live stock, the suppression of which would require stringent if not coercive measures.

The revision of the Territorial Statutes having just then been finished it was decided to use the statute creating the Board of Agriculture and Forestry as a foundation, amending and adding to the same in such a manner as to make it embrace the importation of live stock, as well as agricultural products, and to furnish the required authority upon which to base rules and regulations pertaining to the control and eradication of animal diseases within the Territory. A new section providing for the appointment of a territorial veterinarian and superintendent of animal industry as well as for assistants, deputies and live stock inspectors, and defining their duties, was added. On the basis of this statute, rules and regulations have been promulgated from time to time, of which but seven are in force today, one of which is now superfluous owing to the complete eradication of the disease for the suppression of which it was issued.

LIVE STOCK INSPECTION.

When the said statute went into effect, on July 1, 1905, the writer was appointed Territorial Veterinarian and Superintendent of Animal Industry, and having already ascertained that probably none of the animal diseases most prevalent here were indigenous to the Islands but had all been introduced with imported live stock, the first step taken was to provide protection against the further importation of diseased animals. Having at that time been an officer in the service of the federal Bureau of Animal Industry for more than eleven years, it seemed but natural to invoke the assistance of the federal authorities for the purpose in question. Such a proposal was however entirely new at the time and more than two years of persistent efforts were required before the Bureau at Washington consented to grant Hawaii the same protection as that extended to foreign countries, notably Canada. and Federal inspection and testing of horse stock for glanders and cattle for tuberculosis were established. This privilege remained unique for Hawaii for a number of years, and only quite recently have the States on the mainland succeeded in obtaining that protection against infection through diseased live stock in interstate trade to which they had been entitled all along, but of which they were not aware or else did not care to avail themselves.

Glanders.

In the meantime the inspection and testing of horse stock and cattle at San Francisco, before shipment to Hawaii, had been carried on by practicing veterinarians, one of which had been appointed an inspector by this Board; but the nefarious habit of shipping suspicious, reacting or even physically diseased animals to distant Hawaii had become so thoroughly established that such animals continued to arrive, in spite of every effort on the part of our inspector; and as the California state authorities declared themselves unable to do anything in the matter an embargo of three weeks quarantine was placed on all horse stock coming from or through that State to Hawaii. This measure went into effect on July 1, 1908, Federal inspection having already been established on January 1 of the same year. But even after this latter measure went into effect a shipment of eight mules arrived here with an infected animal that developed acute glanders shortly afterwards, for which reason the quarantine was decided upon. Since that time, however, it may be said that little inducement was left for the dishonest dealer to try to palm off reacting or fake-tested animals on the Hawaiian buyers, and the work of eradicating the diseased animals already here could begin with some hope of success. The ultimate result of these efforts, as it appears before us today, that is, the complete eradication of glanders from the entire Territory, will be discussed later.

Bovine Tuberculosis

Next in importance to glanders, in so far as importation of diseased animals was concerned, came bovine tuberculosis. If equally effective precautions could have been taken against this disease as against glanders, thousands of dollars might have been saved to the local dairy industry. But the insidious nature of the disease and the ease with which every safeguard and regulation may be circumvented by the unscrupulous dealer, breeder, and veterinarian, coupled with the almost universal spread of the infection, all tended—as they do today—to frustrate our efforts at excluding infected animals. Hawaii needs fresh dairy blood all the time, and the northern Pacific Coast States are the nearest and most convenient places to obtain it. The question, however, is where to find uninfected and non-exposed dairy cows, as there is probably not today a single herd of any considerable size, in either California, Oregon or Washington that can be officially guaranteed free from tuberculosis. The local dairy men and breeders have therefore been compelled to rely on the tuberculin test exclusively, which, even if applied most conscientiously, can only show that the animal being tested is, or is not, actually affected with tuberculosis, but does not exclude the possibility of it being infected, especially if coming from an infected herd. Consequently, there can be little doubt that many infected dairy and breeding cattle have arrived here, even after a rigid test had been insisted on and the animals had been passed for export by the official inspectors. But nevertheless, had it not been for this official testing and inspection it is safe to assert that many more centers of infection would have been established here, and have continued to disseminate the infection throughout the country, had it not been for the campaign of eradication which was begun five years ago, and which led to the speedy discovery of infected animals in all herds where efforts were being made to stamp out the disease. So even if less effective than the glanders regulation, the anti-tuberculosis measures have served their end to the fullest extent that could be expected.

Sheep Scab.

After horse stock and cattle had been safeguarded in this way attention was next called to sheep and swine. The great flocks of sheep, especially on Molokai and Lanai, were found to be badly infected with sheep scab, a disease which seemed to have always been more or less prevalent among them. As nearly all of the North Western States were likewise heavily infected with the sheep scab parasite, to such an extent in fact that it became necessary for the Federal authorities to assume control of all inter-state traffic in sheep, and even to undertake the actual eradication of the disease within individual states, it was clear that the unrestricted importation of sheep from these localities could only serve to increase the disease in these Islands. A regulation requiring official certification as to the absence of the scab mite in imported sheep was therefore promulgated. The burden of carrying this regulation into effect was also assumed by the Federal authorities, as soon as it was demonstrated that strenuous efforts were being made here to eradicate the disease by means of "dipping." Here again the ultimate results, that is, the practical eradication of sheep scab, will be touched upon later.

Texas Fever.

Of all the dangers threatening the live stock industry of the Territory, and especially cattle raising, none however compared to that of Texas fever. That this disease had not gained an entrance here previous to the establishment of the Division of Animal Industry is little short of a miracle, and when the fact that the cattle tick, the carrier of the Texas fever infection, did not exist here was reported to Washington, stringent measures were immediately taken by the Federal Bureau of Animal Industry to prevent its entrance into this Territory. At that time the tick infested Texas fever district extended well up over Southern California, and when it is remembered that the introduction of a single Texas fever tick might have wiped out the entire cattle industry before the nature of the disease could have been realized and adequate measures taken against it, it must be admitted that the establishment of the Division of Animal Industry was most important.

Hog Cholera

The next disease on the program was hog cholera, which at that time was decimating the annual hog production in the States with unfailing regularity. While the disease was found to exist here it generally appeared in extremely mild form, due undoubtedly to climatic conditions, and showing a tendency toward constant attenuation if no new centers of virulent infection were introduced. A regulation was therefore promulgated prohibiting the importation of swine except from districts officially recognized to be free from hog cholera infection, and prescribing rules for the prevention of infection while in transit. These measures were effective, to the extent that hog breeding increased within the Territory to the point where further importations were no longer required. Previous to this as many as 7,000 butcher hogs had been imported in a single year. Every effort was made to encourage swine breeding within the Territory, and by 1908 importations were limited to pure bred animals, for breeding purposes only.

These conditions continued unchanged for more than four years in the Territory, regardless of the steady increase in the demand for pork, producing all the market called for, and at reasonable prices. In 1911 and 1912 however, hog cholera again made its appearance, especially in Honolulu and vicinity, where a considerable number of hogs were lost. This reappearance of the disease could not be traced to any individual importation, but must be ascribed to a recrudescence of the infection already here, favored by the reduced power of resistance characteristic of graded and pure bred stock and by the concentration of large numbers of hogs on already crowded premises. The fact that the disease was not brought in with imported stock is fully borne out by the insidious course of the renewed outbreak. No actual epidemic occurred, but the hogs began dying, one here and one there, but not a sufficient number in any one place to cause apprehension or to make the Oriental hog raisers report the losses and apply for assistance in controlling it. In the Moiliili District, especially, nearly a thousand hogs were lost before any knowledge of the outbreak reached this office. After the reappearance of the disease vaccination with hog cholera serum was resorted to with good success, and an effort was made to confine it to the Island of Oahu, by promulgating a regulation prohibiting the shipment of hogs from this Island to any of the others. Nevertheless the disease appeared in the same insidious way on both Hawaii and Kauai, and while never of a very virulent type, has caused sufficient loss again to require the importation of butcher hogs. During the period 1913-1914, besides 53 head of breeding hogs (Berkshire, Hampshire, Tamworth and Duroc-Jersey's) there were imported 1534 butcher hogs, and some time will undoubtedly elapse before the Territory will again be able to supply the demand for pork products.

Rabies.

Last but not least among the diseases that this Division has guarded against by sanitary measures must be mentioned rabies or hydrophobia, which has been prevalent in the United States for many years, and which affects all classes of live stock as well as man. It was however not until 1909 that the first case of rabies was reported west of the Rocky Mountains, and the disease became epidemic in California in 1910. From there it spread rapidly to Oregon and Washington, the infection getting beyond control when wild animals, notably wolves, coyotes and foxes, became affected. The disease being invariably fatal to human beings unless submitted to treatment without delay, it has become necessary to establish Pasteur institutes at convenient places throughout the infected States, not less than eight being now in operation in California alone. This disease has cost the Pacific Coast States hundreds of thousands of dollars in loss of live stock and for preventive measures, not to mention dozens of human lives.

What makes the disease so dangerous is its occult course and the often extremely long period of incubation before definite symptoms manifest themselves, the first symptom often consisting in the infected dog attacking its owner or whatever other person or animal may be near. All warm blooded animals are susceptible, the infection being transmitted almost exclusively through the bite of the enraged suffering animal. The importance of guarding against the introduction of such a disease into this Territory at once became manifest, and in January, 1912, a regulation requiring the quarantine, for a period of four months, of all dogs before admission, was promulgated by this Board. Since that time several hundred dogs have arrived here, and though quite a number of attempts at circumventing the quarantine regulation have been made, and though it is not impossible that some dogs may have gained entrance in spite of it, we have fortunately been spared an outbreak of the disease so far. The four months quarantine has naturally proved a hardship on many dog owners, and has been a considerable expense to the Territory, but that is but a trifle compared to the cost in money and lives that would result from the introduction of a single infected animal. Most trouble has been experienced with tourists arriving here with pet dogs and claiming ignorance of the quarantine requirements, but this may now be considered a past stage. Dog lovers and sportsmen can still obtain hunting and other dogs, free of quarantine, by getting them from either England, New Zealand or

Australia, all of which countries are free of the disease, due to the stringent quarantine measures (six months quarantine) which have been in effect there for years.

SUPPRESSION OF DISEASES.

From the preceding pages it will be seen that the proverbial ounce of prevention has been of inestimable advantage to this Territory during the past ten years in so far as the exclusion of live stock diseases during the past ten years is concerned, and when to this is added the fact that a number of other devastating diseases, such as anthrax, blackleg, foot and mouth disease, cattle mange, dourine and infectious abortion, which annually cost the United States millions of dollars, have never been allowed to gain an entrance here, then it must be granted that the live stock raisers of Hawaii are favored beyond any other known country.

And yet the advantages do not stop with those of a preventive nature. While keeping out the diseases that science has taught us to guard against, an equally important part of this Division's work has consisted in suppressing and eradicating the diseases which already had become established here and which threatened the entire cattle and sheep industry.

Glanders.

On the first page of the first annual report of this Division (1905) occurs the following sentence: "I have come to the conclusion that the greatest source of loss to live stock, direct or indirect, may be traced to three diseases—glanders among horses and mules, tuberculosis in cattle and scabies in sheep." These three diseases were therefore entitled to be considered first and, as glanders and sheep scab, at that time, were far more destructive than bovine tuberculosis, they naturally came in for immediate attention. A circular describing the symptoms of glanders was widely distributed and attention called to the obligatory notification requirement and the penalty for failure to report suspicious cases. By this means many of the worst centers of infection were located and destroyed, cases with profuse nasal discharge and festering sores were slaughtered by the dozen and all infected premises disinfected.

The most effective preventive measure however was the abolition of all public watering troughs, a universally acknowledged precaution against the spread of glanders, and one which still remains in effect throughout the Islands. With the exception of the island of Kauai, where glanders never gained a foothold, all of the principal islands appeared to be thoroughly infected, and the annual loss from glanders has undoubtedly reached the fifty thousand dollar mark more than once previous to 1905. After that the losses gradually decreased, being in subsequent years estimated, by actual count of the destroyed animals, at figures ranging from $30,000 down, until the last big outbreak in Waipio Valley on Hawaii in 1913, where nearly forty head were destroyed. More than two years have now passed without a single authentic mallein proved case of glanders occuring in the Territory, a record never equalled anywhere else in the world. At no time during this ten years campaign has the Division of Animal Industry been aided by that most effective means of eradication, viz., the indemnification of owners of diseased animals. Attention must, however, be called to the establishment of the live stock sanitary service on Hawaii and Maui and the work done by the Deputy Territorial Veterinarians on those Islands, without which complete eradication of glanders could never have been accomplished.

Sheep Scab.

Second in importance to glanders was sheep scab. This disease had gained an absolutely destructive foothold in the Islands, especially on Molokai and Lanai, but also on Hawaii. The work of eradicating the disease was first begun on Molokai when more than 100,000 sheep were dipped during the first three or four years. Dipping vats were also established on Hawaii and Lanai, and while little is known definitely about the present state of infection on the latter island, except that it is greatly reduced from what it used to be, it may be claimed that sheep scab has ceased to be a menace to the sheep industry of the Territory, and that what little infection may remain is well under control, and can easily be eradicated whenever the sheep raisers apply themselves to it.

Bovine Tuberculosis.

Bovine tuberculosis was introduced here many years ago. An attempt at eradication had been essayed a few years before the arrival of the writer, and while undoubtedly a number of tuberculous cattle were destroyed at the time, this effort served principally to arouse antagonism and prejudice against all measures of control and suppression. In fact, the campaign referred to had been handled so unsystematically that a number of the then leading dairymen were on the point of going out of the business entirely, even though a considerable indemnification was being paid for destroyed animals. The failure in many cases of proving the presence of the disease in valuable animals condemned on the tuberculin test, either by failing to find the lesions on post mortem examination or else by making no such examination at all caused, as stated, such profound antagonism that the Commissioners of Agriculture felt constrained to oppose the writer's recommendations in so far as bovine tuberculosis was concerned, until the value of such measures had been more fully demonstrated in other parts of the world. When to this public feeling was added the profound impression made by Prof. Koch's unfortunate failure at recognizing the transmissibility of bovine tuberculosis to human beings, the reason why this important work was not taken up until 1909 or 1910 is explained.

While this is not the place for a detailed discussion of the bovine tuberculosis campaign of this Division it must be stated that the disease was becoming more prevalent every day, and that slaughter house records as well as the results of private efforts at eradication all indicated that the further postponement of vigorous measures of control would either mean failure or would at least increase the cost of eradication immeasurably. After the writer had attended the International Tuberculosis Congress in Washington, D.C., in 1908, where Prof. Koch made his last stand against the danger of bovine tuberculosis to human beings, and when practically the entire civilized world woke up to the necessity of unrelenting fight against this deadly insidious disease, which was even then decimating the native population of this Territory, the time seemed ripe for the inauguration of a vigorous campaign against it here. Even then the results of the first tuberculin test of the dairy herds of Honolulu came near to being fatal to the cause, nearly 23 per cent of the local milch cows reacting to the test, that is, 471 head out of 2,095 were condemned and destroyed. But public sentiment was aroused, and demanded clean milk from healthy cows. The course of the resulting campaign against bovine tuberculosis has been reported on so often that it is not necessary here to go into further detail except to say that in so far as the City and County of Honolulu is concerned it is now extremely doubtful whether any milk from a tuberculous animal ever reaches a milk consumer, unless it is from privately owned cows over which no control can be exercised. This statement is supported by the Territorial Board of Health records, which show a reduction in the prevalence of tuberculosis among children in this county of 75 per cent since the beginning of the campaign, or rather, since all the badly affected animals have been destroyed. While a total of nearly 1,300 head of tuberculous cattle have been killed, without paying any indemnity to the owners, the time seems to have come when the ultimate complete eradication of the remaining infection must be supported by public reimbursement for animals destroyed "*pro bono publico.*"

While the tuberculosis control work at first was aimed at milch cows only, it has gradually been extended to embrace all breeding stock. The last year's work, including many retests of the same herds, has required the application of not less than 7231 tuberculin tests, by means of which a total of 151 reactors were located, or 2.08 per cent. Of this number 114 have already been destroyed, leaving 37 reactors, of which number 31 belong to two owners, who have them safely segregated miles away from their dairy premises.

Beginning the new year with this unparalleled record, and especially if the coming legislature should see its way clear to encourage the final efforts at complete eradication by a sufficient appropriation to allow of a 75 per cent indemnification as it is done in the District of Columbia, there is every reason to hope that the Island of Oahu at least may be proclaimed free of bovine tuberculosis before the end of 1915. There will then remain the other islands, on two of which—Hawaii and Maui—the past year has seen splendid progress made. Dr. Elliot has practically cleaned the Glenwood and South Hilo districts of tuberculous cows, while Dr. Fitzgerald, on Maui, has inaugurated a vigorous campaign that promises well for that island. On Kauai unfortunately, there seems to be decided opposition to the furtherance of the work, even though bovine as well as human tuberculosis appear to be more prevalent there than anywhere else in the Territory. In fact, the Territorial Board of Health has inquired if the prevalence and alarming increase of tuberculosis among the children on that island might not possibly be due to the extent of the disease among the dairy herds. If such should prove to be the case, especially with the favorable results on this island in view, the dairy herds of Kauai must be cleaned up and the danger of infecting children with milk from tuberculous cows eliminated. But none of the three deputies can be expected to carry on an effective campaign, which necessarily must include every dairy herd in their respective districts, without appropriate remuneration and support from their municipalities or from the Territorial government. This again is a matter that should be strongly called to the attention of the incoming legislature.

Hog Cholera.

As already mentioned under the head of importations of live stock, hog cholera never became active here until a year or two ago when quite a number of hogs died in and around Honolulu. This disease can now be effectively guarded against by vaccination, though this method, being still in its infancy, is somewhat expensive. Protective, and especially curative, injections of hog cholera serum cost from one to three dollars per head for mature animals, but the prospects are that this price may be materially reduced in the near future. The actual immunization of hogs against cholera requires their exposure, at the time of vaccination, to virulent hog cholera, either by the vaccinated animals being placed among diseased hogs or else by the simultaneous injection of a dose of hog cholera virus. This, however, is not without danger, and we have therefore not encouraged its use, but recommended the vaccine only. In fact, we have discouraged the importation of the virus required for the socalled serum-simultaneous method. This has caused some dissatisfaction, but the policy will be adhered to until more assurance can be felt that the introduction of a virulent strain of hog cholera virus may not cause a fatal epidemic which, if once beyond control, would leave few if any hogs in the Territory. The disease is undoubtedly here, but in a very mild form and a highly virulent strain of the disease (virus), such as is used for immunizing purposes, might prove disastrous if one single drop was spilled on the ground during the process of vaccination.

On the other hand everything is being done to encourage hog raising, and recent large importations of brood sows seem to promise that the Territory may soon be able again to keep itself supplied with hogs. A form of insurance company is being organized with a view to keeping on hand a sufficient quantity of hog cholera serum, or vaccine, a commodity possessing only transient effectiveness, that is, it deteriorates after a certain length of time and cannot be returned to the manufacturers and exchanged for fresh material. The druggists can therefore not be expected to keep it on hand unless the hog raisers are willing to reimburse them for losses from deterioration. And as the vaccine produces only passive immunity, unless applied simultaneously with exposure to virulent hog cholera, vaccination can, economically, be resorted to only in herds or districts where the disease makes its appearance. It therefore becomes necessary to inject only animals that are exposed.

IMPROVEMENT OF LIVE STOCK.

To close without at least a casual mention of the activities of the Division as regards animal husbandry in the Territory would be to disregard an important branch of the work. The development and improvement of the various classes of live stock in the Islands has never been lost sight of, and no opportunity has been neglected to encourage the importation of pure bred sires and dams. To say that the domestic animals here today are infinitely superior to what they were ten years ago, does not necessarily mean that nothing had been done previous to that time to improve them, but every stock breeder here will undoubtedly agree that the development which has taken place during that time by far exceeds that of all previous efforts. The Parker Ranch Company alone has aided immensely in increasing the value of the live stock in the Islands, although practically every ranch manager in the Territory has departed from the use of common or cross bred sires. That there still remains much unimproved stock is natural, ten years is but a short period when it comes to revolutionizing an extensive industry, and if the same progress is maintained during the next ten years, it is safe to predict that the "scrub" will become extinct, as hundreds of pure bred pedigreed sires and dams have been imported. During the past few years the stock breeders of the Territory have sold to the United States Army hundreds of island-bred horses, fully up to their stringent requirements, and what is more, the local breeders may have to supply all the animals needed by the cavalry and artillery stationed here, because it will probably be impossible for them to obtain their animals anywhere else, unless the United States, like other neutral countries, forbids the exportation of horses and mules.

From the beginning of the sugar industry mules have been imported here in every increasing numbers and demand for them will continue so long as that industry is in existence. But up to the present time the Territory has never produced these animals in appreciable numbers, except in so far as pack mules (450 to 700 lbs.) were concerned. As far back as 1906 this Division began urging the breeding of larger mules here, it having been conclusively shown that such animals could be raised here, when sufficiently large mares were used. To produce the mares here first and then import pedigreed jacks for mule breeding, appeared like a very risky undertaking, requiring from six to nine years before the first crop of mules would be of marketable age, and still, a careful analysis of the question satisfied Mr. Carter of the Parker Ranch that this was the only sane solution of the problem. He therefore imported a number of Percheron stallions and bred them to the heaviest mares on the ranch, the colts being broken to harness early and put to work at producing the corn necessary for their own development and that of their future offspring. The experiment proved a complete success, and while a tempting market was ready to absorb all the resulting offspring, only the male animals were disposed of. About four years ago the fully developed half-bred and three-quarter blood Percheron mares were bred to some of the best jacks imported from Kentucky, Tennessee and California, and the young mules, now maturing, promise to equal the best Missouri and California bred mules ever imported here. The foresight and courage exhibited by Mr. Carter in this undertaking will undoubtedly prove of immense importance to the Territory, entirely aside from the financial advantages to accrue from it, since the great European war is bound to deplete the mule market of the United States to an extent that will send prices soaring.

Besides Percherons, the Parker Ranch also has imported a number of full blood, standard bred and German Coach stallions, probably the most famous polo pony in the world, "Carry the News," having been bred and raised on that ranch, together with many others just as good, though less famed. This is the class of horses especially desired for the cavalry—the half or three-quarter fullblood cross with the stocky native mares—while the artillery requires a somewhat heavier animal, as for instance a cross with the German Coach or Hannoverian. An officer's mount however must now be at least part thoroughbred, and especial attention is called to the efforts of Dr. Fitzgerald, the Deputy Territorial Veterinarian on Maui, to encourage the breeding of this class of animals in the Territory.

The improvement of sheep and cattle in the Islands through the importation of pedigreed stock has simply been enormous, the Parker Ranch, for instance, now using only pure bred bulls, mostly Herefords and some Shorthorns while the great flocks of sheep are being constantly improved by the annual importation of from fifty to one hundred Merino rams from either California or New Zealand.

While the Island of Kauai used to be the leading producer of high grade live stock, both horses and cattle, comparatively few purebred animals have been imported during the past ten years. Maui, on the other hand, is progressing steadily in so far as live stock and agriculture is concerned, and the same may be said of Oahu where, however, the dairy industry predominates. But none of the Islands import enough dairy stock to keep the herds up to the desired standard.

Of swine a great number of pure bred boars, especially Berkshires, but also Duroc Jerseys, Chester Whites and Belted Hampshires are constantly arriving and very few of the razor backs of ten years ago are seen nowadays. It no longer pays to keep the ranging hog at large as it does too much damage in comparison to its yield in pork and progeny. But the immense quantities of swill, or kitchen offal, which has become available since about 10,000 officers and soldiers have been stationed here, has given an impetus to the hog raising industry never known heretofore, and if the infectious and contagious hog diseases can be kept under control great developments will take place in the near future.

In conclusion the poultry and egg business must be mentioned as one that is not at all receiving the attention that it deserves here, even though every condition, except possibly the cost of feed, seems to favor it, but the high price of feed is easily offset by the price paid for both chickens and eggs, and no country was ever more favored by climatic and other natural conditions where poultry farming is considered. The many infectious and contagious diseases of poultry that make this industry so difficult and risky in the States are practically unknown here, but netiher chickens, ducks nor turkeys can be successfully raised on a large scale, even under the most favorable conditions, without constant and diligent attention. And that is the only obstacle that we have been able to locate here, the few diseases which now and then appear among the flocks being easily controlled by prompt application of simple remedies. It is therefore to be hoped that the near future will see the altogether extensive importations of poultry and poultry products materially reduced.

SUMMARY

The results of the past ten years' work by the Division of Animal Industry may be summarized as follows:

(1) The eradication of glanders.

(2) The complete control of sheep scab.

(3) The eradication of ninety per cent of bovine tuberculosis.

(4) The exclusion of rabies.

(5) The establishment of an effective live stock sanitary service throughout the Territory.

(6) The immense improvement in practically all classes of live stock bred here—horses, cattle, sheep, swine and poultry—by the importation of large numbers of pure bred registered breeding stock.

(7) The continued exclusion through effective quarantine regulations of nearly all of the devastating animal scourges of the mainland of the United States and foreign countries.

Respectfully submitted,

VICTOR A. NÖRGAARD,

Territorial Veterinarian and Superintendent of Animal Industry

Report of the Territorial Veterinarian

for the

Biennial Period January 1, 1913 to December 31, 1914.

BY

VICTOR A. NÖRGAARD, V. S. *(Copenhagen)*,
Superintendent of Animal Industry,
Territorial Veterinarian,

and

LEONARD N. CASE, D. V. M. *(Cornell)*,
Assistant Territorial Veterinarian.

THE LIVE STOCK INDUSTRY OF THE TERRITORY.

The biennial period ending December 31, 1914, must be said to have been in most respects favorable to the live stock interests throughout the Territory. The prolonged drought of the previous year extended well into the spring or summer of 1913 and the feed on the ranges became very short, but with the improved water supply of nearly all the stock breeding districts, the losses from this cause were comparatively small.

The vast increase in the consumption of beef and other meats, as a result of the great number of soldiers now stationed here, necessitated the importation of large amounts of beef and mutton from California, as well as from the Colonies, but the expected reduction in price from the removal of the duty on live stock products did not materialize, the foreign exporters advancing the price in direct proportion to the reduction and pocketing the profit that was to have benefited the local consumers.

The past period has seen the sheep industry reduced to a considerable extent in favor of cattle raising, it being generally believed that many of the sheep ranges have been overstocked and consequently worn out, at least in so far as sheep are concerned.

No epidemic of any kind has occurred among either cattle or sheep, but for the first time in four years a considerable number of hogs have been lost from cholera, especially on the Island of Oahu, thereby necessitating the importation of butcher hogs from California. Previous to 1908 this Territory imported annually from 5000 to 7000 butcher hogs, and pork was always a very expensive meat on the local markets. Hog raising was consequently encouraged and urged at every opportunity by the federal, territorial and local live stock authorities until the production of hogs increased to the point when importations were no longer necessary. This condition lasted, as stated, for four years, or until the latter part of 1913, when a shipment of 200 hogs arrived here from Oregon. There is, however, little cause to believe that this condition will last for any length of time, since it has been demonstrated that hog raising is a very profitable business in this Territory, at least to the extent where cheap feed (hotel, mess or kitchen swill) can be obtained, and; further, that there is now a sufficient amount of that feed here to supply the local demand for pork.

Horse and mule breeding has taken an immense upward swing during the past few years, and it is highly satisfactory to report that the past period has demonstrated the absolute fitness, or rather superiority, of locally raised horses for all the branches of the military service stationed here. About three years ago the cavalry began experimenting with Parker Ranch horses, first as polo ponies and then as regular mounts and officers' chargers, since which time about 200 head of horses have been purchased on various ranches on Hawaii and are giving great satisfaction. It may therefore be safely predicted that no more horses will be sent here for military purposes, but that the future needs of the regiments stationed here will be supplied by the local horse breeders. The only possible objection to such an arrangement might be the price asked for Island-bred horses, as there remain but few of the cheap cow-ponies of common-breed stock. All the larger breeders now use only pedigreed stallions of high class. and the colts and young animals are no longer left to care for themselves on the ranges at all times of the year, but are fed. broken and handled and, in fact, looked after and cared for, selected and classified until they can hardly be called range horses any longer; and, as a steadily increasing percentage shows all the qualities and marks of high breeding seen in the blue grass regions of the States, it is obvious that they cannot be sold at the figures which prevailed five to ten years ago. As regards the health of the horse stock, it must be said to have never been better. A few scattered cases of spinal meningitis—so-called—have occurred, on Maui and Molokai principally, but beyond these there has not been one outbreak of infectious or contagious disease worth mentioning.

RULES AND REGULATIONS.

As discussed elsewhere in this report the six regulations pertaining to the importation of live stock from abroad have proved amply effective in guarding the Territory against animal diseases gaining an entrance here.

The appearance of hog cholera on the Island of Oahu however made it seem desirable to attempt to confine its spread to this island, as no suspicious cases had at the time been reported from Kauai or Hawaii. The following regulation was therefore promulgated by the Board:

RULE VII—DIVISION OF ANIMAL INDUSTRY.

Rule and regulation of the Board of Commissioners of Agriculture and Forestry prohibiting the shipment, transfer or exchange of hogs from the Island of Oahu to any other Island of the Territory of Hawaii.

It having come to the notice of this Board that a disease known as hog cholera or swine plague is prevalent among the hogs on the Island of Oahu it is hereby ordered

SECTION 1. Until further notice no hogs, (of whatsoever age, breed, or description) shall be shipped, carried or transferred from the Island of Oahu to any other Island of the Territory of Hawaii, except as specified in Section 2 of this order:

SECTION 2. Hogs arriving at the port of Honolulu from abroad (the mainland of the United States or foreign countries) and destined for other parts of this Territory than the Island of Oahu, may either remain on board the steamer or vessel in which they arrive until final delivery, or if boxed or crated, be transferred for final delivery, when such detention on board or transfer is carried out under the direct supervision of the Superintendent of Animal Industry, his Assistant or Deputy, who will take every precaution to prevent infection in transit.

Hogs imported from abroad, if not boxed or crated, shall upon arrival in Honolulu remain on board for final delivery at a port of entry outside of the Island of Oahu or shall be landed at the port of Honolulu and held there for final disposition and at the cost of the owner, agent or consignee, and shall not be transferred to any other Island of the Territory.

SECTION 3. Any person or corporation violating the above rule shall be guilty of misdemeanor, and upon conviction thereof shall be punished by a fine not to exceed Five Hundred ($500.00) Dollars, as provided by Section 390 of the Revised Laws as amended by Act 82 of the Session Laws of 1905, and Act 112 of the Session Laws of 1907.

SECTION 4. This order shall take effect upon its approval by the Governor.

Approved:

W. F. FREAR,
Governor of Hawaii.

Honolulu, Territory of Hawaii, July 10, 1913.

The disease nevertheless made its appearance on both Kauai and Hawaii, but contrary to the opinions advanced by the deputies in their respective reports, the writer does not believe that the infection reached them from Oahu as little as it seems likely that the Oahu outbreak was due to infected hogs from the Coast. The disease has always been with us, though as a rule in a very mild form, and the losses of the past two years are, in my opinion, due to a recrudescence of the infection, and not to the introduction or transmission from this island to the others of a new and more virulent strain of virus.

IMPORTATIONS OF LIVE STOCK.

The following different classes of live stock have been imported through the ports of Honolulu and Hilo during the two last biennial periods:

	Horses	Mules	Cattle	Sheep	Swine	Dogs	Poultry crates
1911—Honolulu ...	753	625	86	133	13	132	392
Hilo	39	155	47	3	..	..	112
1912—Honolulu ...	411	677	70	106	34	136	595
Hilo	20	241	0	10	..	..	128
Total, 1911-12 ..	1,223	1,698	203	252	47	268	1,227
1913—Honolulu ...	550	710	93	2	227	75	1,330
Hilo	6	6	42	42	11	..	127
1914—Honolulu ...	522	303	75	120	1,666	52	1,114
Hilo	13	76	8	0	9	..	40
Total, 1913-14 —	1,091	1,095	218	164	1,913	127	2,611

The figures for both periods are given in order to illustrate how importations are governed or influenced by various conditions

HORSES.

Considerably over one-half the total number of horses imported during the last biennial period were consigned to the various branches of the U. S. Army stationed on the Island of Oahu. The remaining number consisted principally of light and heavy draft animals of ordinary type. Two thoroughbred stallions and a mare were imported by Mr. Chas. Bellina for the improvement of the racing stock here.

MULES.

There was a considerable drop (40 %) in the number of mules imported during the last two years, due in large part to the critical condition of the sugar industry and the uncertainty in regard to the tariff. The anticipated drop in the price of mules has not been realized, and with the present conditions in Europe, creating an unprecedented demand for this class of animals, prices will undoubtedly go very much higher. However, it is confidently expected that one at least of the large ranches here will soon be in a position to supply a considerable number of first class mules for this Territory.

CATTLE.

There has been a slight increase in the number of cattle imported in which the following breeds were represented:

Holstein, ten bulls and seventeen cows; Shorthorns, fourteen bulls and one heifer; Jersey, three bulls and two heifers; Ayrshire, one bull and two heifers; Angus, fourteen bulls; Brown Swiss, one bull and eleven cows; Dutch Belted, one bull and three cows; Hereford, twenty-six bulls. These animals will furnish the pure blood necessary for the further improvement of both the dairy and beef cattle in the islands.

SHEEP.

As in former years, the importations have been confined to two breeds, Merino and Shropshire. The Parker Ranch has recently imported one hundred and ten of the finest rams, the shipments consisting of fifty American Merinos, fifty New Zealand Merinos, and ten Shropshires. Hind, Rolph & Co. have also imported ten fine American Merino rams. These animals will materially improve the flocks and raise the quality of mutton produced here and soon enable the various ranches to supply, in part at least, the demand of this Territory for mutton.

HOGS.

The importations of swine totaled 1913 for the past two years as against 47 for the previous biennial period. This great increase was due to the importation of large numbers of butcher hogs to meet the demand of this Territory for pork. This is the first time since 1909 that such importations have been necessary, as up to the early part of 1913 the islands fully supplied the demand for hogs. Owing to the great decimation of the herds by hog cholera this supply was greatly diminished, and it was soon apparent that increasing numbers of hogs must come from the mainland.

At the present time the hog cholera situation is greatly improved, and the disease is practically controlled. Owing to the fact that this island was the only one affected to any extent, only two or three small and quickly controlled outbreaks occurring on the other islands, a regulation forbidding the shipment of hogs from Oahu to any of the other islands of the Territory was immediately put into operation and enforced. The great reduction in the price of serum to 1½ cents per cc. will make its use more general, and losses from this disease will be reduced to a negligible quantity. This, together with the already manifested interest of a number of breeders and the remunerative returns which can be obtained from this industry, will soon assure a supply fully adequate to the demand.

POULTRY.

During the last biennial period there were imported into this Territory 2611 crates of poultry as against 1227 crates for the biennial period ending December 31, 1912, or an increase of 1384 crates. Almost all classes of poultry were represented, and while the bulk of the importations were consigned to dealers supplying the various markets, there were also many representative types of the different breeds, such as white, buff and barred Plymouth Rocks, White Leghorns, Black Minorcas, Japanese Games, Indian Runner and Muscovy ducks brought in. This Division is looking forward to the time when the small farmer will materially reduce these importations and supply the market demand with island raised poultry.

QUARANTINE STATIONS.

In connection with the importation of live stock and the above-mentioned absence of disease it is worthy of note that the Board has done everything in its power not alone to guard against the introduction of infected animals, but also to facilitate the importation of valuable breeding animals and assist the progressive stock breeder in bringing such into the Territory with as little cost and inconvenience as possible. To this end two ports of entry besides Honolulu, that is, Hilo and Kahului, were during the past period provided with quarantine stations. The Hilo station cost nearly $3,000, and the Kahului Station about half of that amount. Both stations are of solid construction and absolutely modern in so far as sanitation and hygiene, as well as comfort and convenience, are concerned. The old quarantine station at Hilo was at best a makeshift affair, while importations of live stock for the Island of Maui had to be quarantined, when required, at Honolulu, and were it not for the uncertainty engendered through the change in the national administration, these improvements would undoubtedly have seen a great increase in the numbers of draft and breeding animals imported. The observations made by this Division during the past ten years have, however, demonstrated beyond a doubt that so long as new centers of infection are prevented from gaining entrance it is possible to eradicate the infection already established here. The section of this report dealing with glanders shows this most clearly, and accentuates the necessity for continuing the policy of vigilance embodied in the Board's regulations requiring inspection, testing and quarantine of all live stock coming from or through a state, territory or country known to be infected with one or more of the numerous animal scourges from which the Territory now is free.

The addition of a canine hospital and sanitarium for delicate dogs has been authorized by the Board, and will undoubtedly fill a long felt want. The plans and specifications are already in the hands of the contractor, and the work will be pushed along as fast as possible.

DISEASES OF LIVE STOCK.

GLANDERS.

It is with considerable satisfaction that this Division believes itself justified in claiming that glanders, the most destructive of all equine diseases, has apparently been eradicated from the Territory, especially in view of the fact that the disease was very prevalent here when the Division was established about ten years ago, and that no indemnity has ever been paid for destroyed animals. This is a feat which the best live stock sanitarians have claimed to be impossible, and one that has not been accomplished anywhere else in the civilized world. It must, however, be said that it would have been nearly as difficult here had it not been for certain natural, especially climatic, conditions and resulting circumstances, all of which tended to favor the efforts at eradication. The prime factor, however, was the exclusion of fresh infection with horses and mules imported from or through California and other countries. Owing to the great distance of these islands from the mainland, and to the absolute necessity of importing large numbers of draft animals from the nearest available market, this is, California, it seemed to have become a habit with horse dealers there to unload on Hawaiian buyers latent or obscure cases of glanders, taking it for granted that the diseased animals could not be returned, and that if returned, they would not be admitted to the State, but would have to be destroyed upon return arrival. It seemed therefore to be perfectly safe to ship such animals to Hawaii, and, until the mallein test came into general use, there can be little doubt that many reactors found their way to this Territory. No wonder therefore, that glanders spread through the local stables and pastures until over one hundred outbreaks per annum became the rule rather than the exception, and that the losses from this disease alone at times aggregated $30,000 to $40,000 per year.

With the establishment of the Division of Animal Industry in 1905 a check was immediately put upon the importation of infected animals, although it was not until the cooperation of the Federal Bureau of Animal Industry was enlisted in 1907 that a complete stop may be said to have been effected.

At the same time a vigorous fight against the disease within the Territory was inaugurated and this again led to the appointment of deputy territorial veterinarians on the principal islands, without which the creditable result, that is, the apparently complete eradication of the disease, could not have been accomplished in such a short time, and especially without the payment of compensation for destroyed animals. It is, of course, not impossible that the disease may linger in some out-of-the-way mountain valley or gulch or remain latent in some old "carrier," as was the case in

Waipio Valley, but even so if another outbreak should occur it will soon be apprehended and suppressed, while the intradermal test with mallein is so easy and simple that all exposed animals can be located and rendered harmless with comparative ease.

BOVINE TUBERCULOSIS.

What has been said above in regard to glanders in horse stock may to a certain extent be repeated in so far as bovine tuberculosis is concerned. What has been accomplished here along the line of control, suppression and eradication of this fatal insidious disease of dairy cattle and the resulting improvement of the local milk supply is unparalleled in any other country, state or territory where no indemnification is provided for the destruction of diseased cattle, and where the enforcement of sanitary regulations is in the hands of political employees.

Beginning five years ago with the tuberculin testing of the dairy cows of the City of Honolulu, conditions were met of sufficient severity to discourage the stoutest heart, and, had it not been for the unfailing support of the leading dairymen and their willingness to sacrifice large numbers of their best animals, it is doubtful whether the present satisfactory state could ever have been reached, or at least not until the milk consumers had been educated up to demand pure and wholesome milk for their children.

The first tuberculin test revealed no less than 32% of diseased cows among the Honolulu dairy herds, which figure was reduced to less than 24% when all the dairy cattle of the City and County of Honolulu, that is the Island of Oahu, were tested, and it cannot be disputed that had the test been postponed even one single year the question of eradication would have had to be abandoned and either pasteurization or the "Bang method" of gradual elimination resorted to. But as it was, by far the greater part of the 471 head of reactors to this first test belonged to three or four of the largest dairymen, who were financially able to bear the loss, and who declared themselves willing or even anxious to have their herds cleaned up. There was consequently nothing else for the recalcitrants to do than to follow this step or else go out of the dairy business, as the milk consumers were quick to respond to the movement for sanitary dairies and clean milk and refused to buy from any dairy that was not declared clean officially, even though there was a slight advance in the price of milk from the clean herds.

In the latter part of 1910 (November), the intradermal method of testing was adopted, whereby the greater part of the objection to the work of eradication was overcome. This method, fully described in the previous reports from this Division, has proved absolutely satisfactory, and is fully believed to be the only means whereby the universal eradication of bovine tuberculosis can ever be accomplished.

Since commencing the tuberculin test there has been a gradual decrease in the number of animals found diseased as illustrated by the following percentages:

Year.	Total.	Passed.	Condemned	Per cent.
1910	2095	1613	471	22.48
1911	4269	4044	225	5.27
1912	5353	5149	204	3.81
1913	5162	4961	201	3.89
1914	7231	7080	151	2.08

During the past five years a total of 24,111 dairy and range animals have been tested, out of which number 1,252 have been condemned and branded, with the exception of 20 or 30 head which are completely segregated. All of these reactors were slaughtered without unnecessary delay, and, whenever possible, examined post mortem. In every case but one the pathological changes verified the diagnosis, and proved the value of the intradermal method of testing. All stables where reactors were found were thoroughly disinfected and whitewashed, and all herds containing a high percentage of reactors are now being submitted to the test every three months in order to apprehend any case that may still develop, in its incipiency. In the meantime it may be said that the milk supply of the City and County of Honolulu, to all intents and purposes, is free from tuberculous infection, and it is to be hoped that this good work which has only recently been inaugurated on the other islands, where deputy territorial veterinarians are located, will progress and meet with the same support from the public as has been the case here.

PREVENTIVE MEASURES AGAINST RABIES.

It is now nearly three years since the regulation requiring the quarantining of all dogs coming from or through the territory infected with rabies went into effect.

While the measure has met with a considerable amount of more or less pertinent criticism it cannot be said to have been actually opposed, and it is doubtful whether a single dog, if at all worth while, has been left behind on that account.

The actual number of dogs imported or arriving here with tourists or returning residents fell during 1913 to 75 head as compared with 136 during 1912 and 132 in 1911, showing a still further decline in 1914, only 52 arriving during that year; but this reduction is due principally to an official order restricting the number of pets and mascots which usually arrived here with every regiment, company or troop that was to be stationed here. During the past two years, only officers' dogs have been allowed to accompany the various contingents of soldiers arriving here, thereby eliminating a great number of more or less worthless dogs which otherwise would have crowded the quarantine station. Another cause for the reduction is due in part to the strict six months' quarantine maintained in Australia and New Zealand, which in conjunction with the local quarantine, prevents theatrical companies, such as dog and monkey shows, from bringing performing animals to any of these countries, or which at least makes it so expensive and annoying to the managers that they have practically abandoned the Hawaii, New Zealand, Australian circuit, which formerly concluded such companies' tour of the world. In 1911 for instance, more than 33 per cent of the dogs arriving here consisted of soldiers' pets and performing dogs. That the dog quarantine regulation has proved effective in keeping the disease out until this time is very gratifying, especially when considering that the epidemic prevailing in the Pacific Coast States, so far from being suppressed, is constantly on the increase, and, while a number of attempts have been made wilfully to circumvent the regulation and land dogs here regardless of the quarantine requirements, it is believed that no such attempt has so far been successful, and it is sincerely to be hoped that common sense will prevail among both tourists and resident dog owners and make them realize the awful responsibility they assume in attempting or conniving at the introduction of a dog without quarantine. The last case reported to the Board, from Hayward, California, where one rabid dog bit six persons, a couple of horses and more than twenty other dogs in less than an hour, before it was cornered and shot, furnishes a good illustration of what might happen in this dog-infested district, should the disease gain an entrance here. In the first place it would be necessary to establish a Pasteur institute for the preparation of the vaccine and the treament of bitten persons, a matter of several thousand dollars, and the employment of at least one expert scientist and assistant. California now has seven such official institutions and a number of private ones, in which hundreds of people are being treated annually. But before such laboratory and clinic could be established here it would be necessary to send all bitten persons to San Francisco, in many cases at public expense, and, owing to the distance and length of time required to get there—in some cases ten to twelve days—at great risk to the life of the patient. There is consequenly every reason why this preventive measure of the Board, the dog quarantine, should receive the full support of the public as well as of the press.

HOG CHOLERA.

As already stated, this disease has spread to a considerable extent, and many animals have died. The method of control now in vogue in the States—the injection, subcutaneously, of blood serum obtained from hogs which have been hyperminimized against the disease—has been applied here, and with seeming success; in fact, with highly satisfactory results. It may, for instance, be mentioned that in one herd of 30 to 40 animals of all sizes, and all of which were affected with the disease, some to such an extent that they could not walk, practically every one which was inoculated has either recovered or else improved, while two, which escaped inoculation by breaking through the fence, developed the disease, and one of them has since died, while none of the treated hogs have been lost.

The establishment of a serum institute for the manufacture of hog cholera serum has been considered, in view of the price asked for the commercial serum, which amounts to from two to three dollars for full grown hogs. There is, however, considerable danger of spreading or perpetuating the disease here, as it is necessary to keep on hand animals infected with the most virulent form of the disease, and in view of the limited number of hogs in the Islands the cost of manufacturing the serum here would no doubt prove exorbitant.

For outbreaks of this disease on the other islands, reference is made to the appended reports of Drs. Elliot and Glaisyer. No outbreak seems so far to have occurred on Maui, and if the hog cholera regulation is strictly adhered to, that island should remain free from the disease.

It may further be announced that hog cholera vaccine or serum of guaranteed quality may now be purchased here at a fraction of its former cost, thereby obviating the contemplated local manufacture of it.

CEREBRO-SPINAL MENINGITIS IN HORSE STOCK.

During the latter part of August, 1914, what threatened to be a severe outbreak of this disease was reported from Maui. Upon investigation it was found that six animals had died on one plantation, while one which was found in a dying condition was destroyed for post mortem examination. The result of the latter was, as usual, negative in so far as actual pathological changes were concerned except for the presence of a number of aneurisms on the abdominal arteries, in which were found embedded the embryos of the armed wire worm (*Strongylus armatus*). The mature worm was also found in large numbers in the colon and cecum, but no trace of embryos or infarcts caused by these could be found in the brain. These intestinal and blood parasites play, in the writer's opinion, an important role as a direct, or at least a contributing cause to the appearance of that greatly varying and complex series of symptoms in horses and mules which is most frequently referred to as cerebro-spinal meningitis, though admittedly a misnomer. As part of the life cycle of this parasite is spent in stagnant water, our efforts to prevent the repeated outbreaks of this disease have been principally directed toward the purification of the water supply on premises where the disease occurs regularly, and in a number of cases apparent success in suppressing the disease has resulted. The first rule is therefore to keep all horse stock away from stagnant water, and especially to drain all water holes in the Sunday rest pastures where nearly all plantation draft animals are kept from Saturday afternoon till Sunday evening. When once infected such pastures are, however, not easily purified again, and when partly inundated by persistent rains the parasites are frequently carried to distant localities, where new centers of infection become established, and a varying number of animals become infected and die. The disease is therefore always at its worst during the rainy season, making its first appearance from one to two weeks after the rains set in. In stables and yards where the water supply can be absolutely controlled, much can be accomplished by filtering the water as it comes from the pipes or by sand filters placed on open flumes. Medical treatment is of no use, as the embryos in the blood vessels cannot be reached by any form of medication now known to science, and our efforts must therefore be confined to prevention along the lines indicated.

DISEASES AMONG POULTRY AND REMEDIES.

Poultry raisers have less to contend with in the way of diseases among their flocks in these islands than in perhaps any other place in the world, but nevertheless there are imported annually into this Territory between ten and fifteen thousand head of the different classes of poultry.

Considering the mildness of the climate, the inexpensive buildings which can be erected, the complete freedom from those devastating diseases, such as fowl cholera, found on the mainland, and the excellent prices obtainable for table fowls and eggs, it is surprising that so few people see any opportunity in this industry.

The two diseases which cause the most annoyance and loss to poultry raisers are the eye worm, Filaria or Oxyspuria Mansoni, and contagious Epithelioma or sore head. The former has been fully dealt with in the 1912 biennial report of this Division, and also in an excellent pamphlet by E. V. Wilcox, formerly head of the Hawaii Experiment Station.

Contagious Epithelioma or Sore Head.

Characterization: Contagious Epithelioma among fowls is characterized by a catarrh of the mucosa of the throat and nose and the formation of wart-like growths upon the comb, wattles, nose and skin around the eyes. It is readily transmitted among fowls. Pigeons in this Territory are affected with a disease very similar if not identical with it.

Geographical Distribution: The disease is widespread, being prevalent in Europe and Southern United States and especially in California.

Etiology: The cause of the disease has not up to the present time been demonstrated. It is readily transmitted by inoculation, and experiments have proven that the virus will pass through Burkefeld filters, but is held up by the finer porcelain filters. The causative organism may be classed as ultra-microscopic.

Symptoms: The first manifestation is a catarrh or mucopurulent discharge from the mucosa of the eyes, nose and throat, which is soon followed by the appearance of wart-like growths on the mucosa and extending to the skin. The nodules are at first grayish in color, but later become covered by a reddish scab. At times they are very numerous, and small ones may grow together forming large ones. When situated around the eyes or at the corners of the beak they may so interfere with the eyesight and use of the beak that the bird can no longer see or be able to pick up food, and so dies from starvation. When the warts are situated in less dangerous positions, such as the comb or wattles, recoverey usually takes place in from three to four weeks. One attack seems to confer an immunity.

Transmission: The disease is readily transmitted either by direct contact through crowding on the roosts and around the feeding troughs or by picking the scabs from those affected, and the fallen scabs and scales from those recovering from an attack.

Treatment and Prevention: Treatment should be commenced early when the disease is in the first stage and the bird's vitality is unimpaired, and consists in the application of mild antiseptic solutions such as creolin or chloro-naptholeum of about two per cent strength. When the warts have appeared, the application of pure glycerine to which enough carbolic acid has been added to make a two per cent solution, is very effective. Before being applied, however, the scabs must be removed by means of a needle or pair of forceps.

All sick birds must be removed immediately from the rest of the flock and placed by themselves for treatment, and all yards and houses thoroughly disinfected with five per cent carbolic acid, creolin or chloro-naptholeum. By close attention to the flock and treating the sick ones, immediately they become affected, very little loss will be experienced from this disease.

Besides the above there occurred small outbreaks of the following diseases:

Apoplectiform Septicemia.

During the early part of 1913 there occurred an outbreak of a peculiar disease among chickens at Haiku, Maui. A history of the outbreak, together with post mortem and bacteriological examinations on one of the birds forwarded to this office proved the disease to be *Apoplectiform Septicemia.* A description of this disease is unnecessary here as it is dealt with fully in all its details in an article entitled "Apoplectiform Septicemia in Chickens," by Norgaard, which can be obtained from this office at any time.

Intestinal Coccidosis.

In the early part of 1913 a considerable loss among four to five weeks old chicks was reported from Kaimuki, the mortality reaching as high as 75 per cent of those affected.

Symptoms: Profuse diarrhoea with the evacuation of liquid, slimy, more or less blood-stained feces; increased thirst; the appetite at first normal was finally lost altogether. Those affected became drowsy and listless, isolated themselves and stood with ruffled feathers; the comb assumed a bluish color and there was free salivation. Death occurred in from two to four days, but sometimes suddenly, apparently healthy chicks being found dead in the morning.

Anatomical Changes: Post mortem examination revealed considerable enteritis, especially of the duodenum and caeca, which were covered with small whitish areas. The caeca were filled with fecal matter of a brick red color.

Diagnosis: A microscopical examination of the fecal matter from the caeca and cloaca revealed enormous numbers of oval bodies, Coccidia, the *C. avium* or *C. tenellum.* In size they measured 25 to 35 microns long by 12 to 20 microns broad.

Mode of Infection: Natural infection occurs with the food and other material picked up by the fowls and through the drinking water. In a state of oocyst, the coccidia of the fowl exist from one year to another in the damp soil of poultry yards and in artificial pens where the air and light are insufficient, and so furnish a constant source of infection. It is possible that the disease may be introduced by eggs used in breeding, as coccidia has been found on the shell and in the white of eggs from fowls suffering from coccidosis (Eckhardt).

Treatment: Various treatments have been recommended, such as the administration of 0.006 to 0.01 gm. of calomel or a few drops of castor oil, with two or three drops of the oil of turpentine (Morse). Sodium subsulfurosum in 0.3 gm. doses for chickens have been used with some success by Railliet and Lucet. Klee recommends 5 gm. sulphate of iron and 15 gm. pure glycerine in one quart of boiled water for pigeons. The treatment which we advocated, and which seemed to give excellent results, is the administration of sulphate of iron in the drinking water in the proportion of 4.0 to 5.0 gm. in one quart of water, and keeping this before them all the time.

Prevention: Separate the sick from the healthy ones at once, and thoroughly disinfect the coops and yards from which they came. Liberal applications of strong solutions of carbolic acid, creolin or chloro-naptholeum are recommended. The yards should be kept as dry as possible, and all droppings removed immediately. Incubators, brooders and all small artificial pens should be disinfected and thoroughly dried.

Intestinal Worms.

Very little loss among poultry is experienced from intestinal worms. One outbreak was observed here among adult fowls due to the *Heterakis perspicillum,* and which occasioned the loss of more than a dozen fine birds.

Symptoms: A gradual loss of appetite accompanied by diarrhoea and increasing drowsiness and listlessness; considerable loss of flesh; weak, staggering gait and a bluish discoloration of the comb.

Anatomical Changes: There were no marked changes in the internal organs, with the exception of the intestines, in which there was considerable catarrh of the mucous membrane. They were filled throughout their entire length with long, slender, yellowish colored round worms. In places the intestinal canal was entirely blocked and the walls distended by these worms. A few were found in the crop into which they had worked their way.

Diagnosis: A study of the worm classified it as the *Heterakis perspicillum,* which has been known to cause severe epizootics among fowls. It is dirty yellow in color, and in length measures 3 to 8 cm. in the male and 7 to 12 cm. in the female. The mouth is surrounded by three lips, the pharyngeal bulb is indistinct, and the tail ends in a sharp point.

Treatment: Megnin recommends mixing powdered santonica with the food, the dose being 4 to 5 gs. for each ten birds. Havette obtained very good results from a mixture of equal parts of the root of male fern, tansy and savory, of which he made a decoction, about 300 gms. of the mixture to 1½ litres of water. The resulting fluid was mixed with flour, and of this pills were made which were forcibly administered to the diseased birds.

THE INTRADERMAL TEST AND ITS IMPORTANCE IN THE CONTROL AND ERADICATION OF BOVINE TUBERCULOSIS.

The success of any campaign against bovine tuberculosis depends upon the tuberculin test. It is the only reliable means of detecting the disease in its different stages. A physical examination alone cannot be depended upon, and is being used less and less by all progressive countries in their tuberculosis control work.

The degree of success obtained in any systematic work against tuberculosis is going to depend entirely upon which of the various methods of testing recommended by different investigations is decided upon, and that method should be selected which enables one to handle the largest number of animals, whether they are wild or tame, stanchioned cows or range cattle.

In the campaign against tuberculosis in this Territory we have for the past four years used the intradermal test first recommended by the French investigators Moussu and Mantoux. Our experience, after making some thirty thousand intradermal injections, has convinced us that this method, with the improvements which we have inaugurated, is the most effective and economic in existence today.

The intradermal test has many advantages over the other methods, especially the subcutaneous. Larger numbers of cattle can be handled at a time, and range cattle can be tested as readily as stanchioned dairy cows. It makes little difference how high an animal's temperature may be at the time of injection, provided, however, that this high temperature is due to a state of excitement and not to a diseased condition. It cuts down considerably in time, labor and material, and in work of this character that means a big saving in the expense account. Post mortem examination has proven it fully as reliable as the old subcutaneous method, which means that it is a correct means of diagnosis in above 98.36 per cent of cases which, considering the nature of the disease, is as high as we can well expect.

During the years 1911, 1912 and 1913, with the exception of increasing the dose, the same technique was employed as that used by Moussu and Mantoux, a description of which can be found in the biennial report of this Division for 1912. Early in 1914, however, the technique of this test was materially altered in that the injection was made in the skin of the lower eyelid instead of the subcaudal fold.

The use of the lower eyelid has demonstrated some very decided advantages. The disadvantages in using the subcaudal fold were: the inconvenience and length of time necessary to properly confine an animal preparatory to injection, especially so in animals at all wild or excitable; the danger of injury to the operator

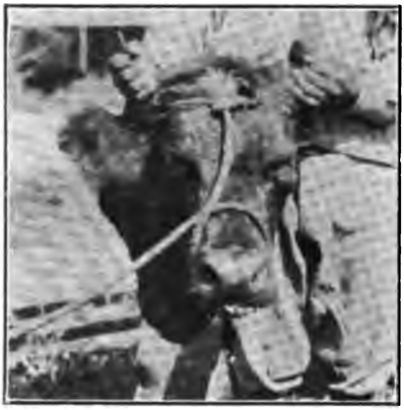
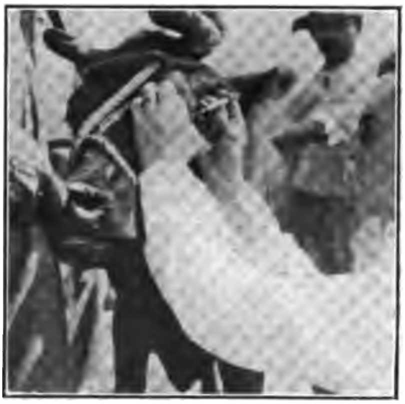


Plate 20.
The Intra Dermal Tuberculin Test, with injection in lower eyelid.



Typical reactions to the Intra Dermal Eyelid Test. The Jersey bulls in the two lower pictures had passed the test only three months before, but reacted when retested.

through kicks from vicious animals; the invariably soiled condition of the fold from feces and urine, rendering liable contamination and infection, and making it necessary to wash or disinfect the part; sores, caused in this Territory by the Horn Fly and the consequent thickening and toughening of the fold, all of which had the tendency to render obscure or doubtful any swelling which might occur; and finally, it is not the part best adapted to a test such as the intradermal because of the apparently low sensibility of the skin in this region.

The advantages of using the lower eyelid are that the head can easily and quickly be confined whether the cattle are in stanchions or in a chute; the operator is out of all danger and in a far better position for making a perfect injection; the field of operation is rarely if ever soiled and needs no washing nor disinfection; and finally, the skin is soft, pliable, highly sensitive, and as such is a far better indicator of the presence or absence of tuberculosis than is the subcaudal fold. The swellings resulting from inoculation are much larger in fact very conspicuous, and if a sufficient dose of tuberculin is used all reactions of a doubtful character are practically eliminated.

TECHNIQUE.

An assistant seizes the animal's nose, with a pair of "bull tongs," the handles of which are 6in. to 8 in. long, and with the left hand grasps the horns, or ear, if the horns are not present, and turns the head until the left side is uppermost. The operator then picks up the skin of the left eyelid between the thumb and index finger of the left hand and inserts the needle in a direction parallel with the margin of the lid. The point of inoculation is about 1 cm. below the margin of the lid, and 1½ cm. from the inner canthus of the eye. When the head is released the injected tuberculin appears as a small lump the size of a pea.

DOSE.

The dose which experience has demonstrated necessary to secure the best and most uniform results is ¼ cc. Counting 16 drops to 1 cc. makes the dose four drops, but to state the amount used as this or that number of drops leads to confusion and error as the amount of tuberculin actually injected depends upon the size of the drop forced from the syringe and this in turn depends entirely upon the guage of the needle used, consequently an operator using a fine needle would be liable to inject too small an amount of tuberculin and would therefore obtain doubtful or confusing results. Stating the dose as ¼ cc. assures the injection of a uniform amount of tuberculin regardless of the size of needle used. Experience has demonstrated that it is possible for a tuberculous animal not to react at all or give a doubtful reaction when too small an amount of tuberculin is used. Especially is this true of that class of animals in which the disease has been present for some time, either in a localized or generalized condition, and whose tissues have lost to a certain extent, that highly sensitized condition always found in those showing recent lesions, and consequently in the first stages of the disease. The style of syringe used will vary according to the ideas of different operators. In the work here we have used for the past three years and with excellent results, the "Record" 1 cc. glass barrel syringe with twenty-two guage needle to fit, and it is an ideal instrument for this work. The tuberculin which we are using, the value of which has been fully demonstrated, is that produced by the Bureau of Animal Industry for subcutaneous use and reduced in this laboratory by evaporation to one half its volume.

CHARACTER OF REACTION.

The reaction consists in a swelling at the point of inoculation of the tuberculin, and which, in the majority of cases, reaches its height and assumes definite characteristics forty-eight hours after injection. Because of the fact that in a certain number of cases the reaction may be delayed, the examination should be made seventy-two hours after injection. There is no evidence that reactions are delayed beyond this period, or at least very rarely so.

Commencing on an average of half an hour after inoculation the pea-sized lump caused by forcing the tuberculin into the skin gradually increases in size until at the end of an hour it is almost as large as the end of the thumb. This swelling in the non-tuberculous animal remains at this point for five or six hours, when it gradually disappears. In the tuberculous animal, however, this initial swelling commences at the end of ten or twelve hours to increase in size until in 48 hours, or in some cases 72 hours, it has reached its height. This final swelling may be size of an English walnut or it may be as large as the fist, almost closing the eye and giving the animal a very dolorous appearance.

While this localized swelling is depended upon entirely as indicating a tuberculous animal, there are at times other phenomena connected with its appearance. There may be partial or complete loss of appetite, also malaise accompanied with a rise of temperature. These are systemic disturbances. There are, however, certain abnormal conditions connected more intimately with the swelling itself, viz., very frequently there is an increased flow of tears which, instead of passing through the lachrymal canal in the normal manner pass over the margin of the inner canthus of the eye, and flow down the cheek, causing a dark streak of wet and matted hairs; in a certain few cases there is noticed more or less mucopurulent discharge from the eye and a reddening of the conjunctiva, in fact all the symptoms typical of an opthalmic reaction and which may be explained by an extra deep injection having been made and a consequent percolation of some of the tuberculin to the conjunctiva. That the eye itself becomes extremely sensitive is evidenced by the fact that many reactors, especially on the range, when exposed to a high wind endeavor to turn away from it, and when this is not possible they will keep the affected eye closed.

The swelling itself whether large or small, is quite firm to the touch and varies in sensitiveness, being more sensitive in some animals than in others. On many of the larger swellings irregular hemorrhagic areas a half inch to an inch and a half in extent surround the immediate point of injection of the tuberculin. The swellings remain in evidence from five to seven days.

The intradermal test is a very potent factor in the control of such a rapidly spreading disease as bovine tuberculosis. It is imperative that all the diseased animals in a herd be discovered as quickly as possible and to accomplish this the entire herd must be tested. Half way measures will lead to nothing but discouragement and failure. The above test offers the very best means of determining the amount of tuberculosis in either dairy or range cattle. An expert with the proper amount of intelligent assistance and properly constructed chutes can inject close to a thousand animals a day, and so in a comparatively short space of time go through large herds and by a glance or a touch pick out the ones diseased.

While the intradermal test is considered superior in every way for the purpose in view, the complete eradication of bovine tuberculosis, no claim of infallibility is made for it. An infected animal still in the period of incubation will not react to this or any other test and such an animal will resist the formation of lesions for a varying period of time depending entirely upon the degree of its own vitality and that of the invading organisms, and not until such lesions are formed will this animal react. This is one of the reasons if not the main one, why reactors continue to be found test after test in those herds where the original percentage of tuberculosis was high. There is still the problem presented by those cases of arrested activity with healed lesions and those cases of extreme generalization which may not react. A careful physical examination will detect the latter, and the former are reduced to a minimum through the use of the intradermal test.

This test is extremely searching in character. Depending as it does on the hypersensitive condition of the skin, few cases of latent tuberculosis will be found where this condition has entirely disappeared, and hence show no reaction when injected. Reactions in cases of this nature will be small as there seems to be a direct relation between the size of the reaction and the degree of sensitiveness of the skin. A study of the lesions found on post mortem examinations would seem to indicate that large reactions denote either recent infections or increased activity of the disease around old lesions while small reactions indicate latent cases with encapsulated and calcareous lesions or cases of generalized tuberculosis.

RESULTS OF TEST.

During the biennial period ending December 31, 1914, 12,393 head of cattle received the intradermal test, out of which number 352 were condemned and branded. At the present writing there are probably not more than fifteen or twenty of these condemned animals alive, and they are segregated many miles away from the dairies in which they were condemned. Taking each year by itself the test is as follows:

Year.	Total.	Passed.	Condemned.	Percentage.
1913	5,162	4,961	201	3.89
1914	7,231	7,080	151	2.08

By comparison it will be seen from the above table that there was a reduction in tuberculosis among the dairy herds of the City and County of Honolulu of 1.81 per cent, which can be viewed only in the light of a great achievement.

Wherever the opportunity presented itself, post mortem examinations were made upon these condemned animals, either at the public abbatoirs or when slaughtered by private individuals, and out of about two hundred and fifty such examinations, but one carcass was found in which definite lesions of tuberculosis could not be found, and in this case it is very likely that the examination was not searching enough.

CONCLUSIONS.

(1) That the intradermal test is reliable in 99 per cent of cases.

(2) That bovine tuberculosis will be controlled and eradicated more effectively and economically by the use of the intradermal test than by any other method of examination.

THE BACTERIOLOGICAL EXAMINATION OF MILK AND ITS IMPORTANCE IN THE PRODUCTION OF CLEAN MILK.

When we speak of the bacteriological examination of milk we mean the numerical determination of all organisms capable of cultivation under the best conditions as regards temperature, medium, and period of incubation.

The technique which we have adopted and which has given excellent results is that recommended by Swithinbank and Newman in their work entitled "Bacteriology of Milk," and the procedure of which, in brief, is as follows:

Where a dilution of 1 in 500 is used and as a rule that dilution is high enough for all practical purposes, 1 cc. of the original milk sample is removed from the container by means of a sterile pipette and placed in a test tube containing 9 cc. of sterile water and well mixed. This gives a dilution of 1 in 10, or what is termed a "primary dilution."

By means of the same pipette transfer 1 c.. of this primary dilution to a flask containing 49 cc. of sterile water and thoroughly mix. This gives a dilution of 1 in 500 or what is termed the "final dilution." Of this final dilution a sufficient quantity is taken in an especially calibrated pipette and into four test tubes marked 1, 2, 3 and 4, containing 10 cc. of melted agar sufficiently cooled, is dropped .05 cc., 0.1 cc., 0.2 cc. and 0.5 cc. of the dilution respectively. The tubes are then well shaken to ensure an even distribution of the organisms and the contents carefully poured into sterile Petri dishes. They are then incubated at room temperature, which in this climate runs from 22 degs. C. to 30 degs. C. We have found that more uniform results can be obtained by using 1 per cent. agar medium having a reaction of + 1.5 phenolphthalcin and incubating for 96 hours.

At the end of 96 hours the number of colonies on each plate are counted. If they are few, all should be counted; if, however, they are too numerous an estimate count is made by means of Pake's plate designed especially for that purpose. This plate consists of a black disc divided by means of white lines, into a number of different sized rectangular spaces. The Petri dish to be counted should be carefully adjusted in the center of the disc, the cover removed and the colonies counted with the aid of an ordinary reading glass. It is sufficient to count the colonies in say half the number of divisions, estimate from them the average number per division and multiply this by the total number of divisions covered by the dish. This will give approximately the total number of colonies on the dish. Each colony although containing many millions of organisms, is the result of the growth of one single organism, therefore in order to ascertain the number of bacteria in the 1 cc. of milk taken from the original sample it is only necessary to multiply the total number of colonies on the plate by the multiple of the fraction of the final dilution and this by the amount of such dilution. For example: given 0.05 of a dilution of 1 in 500 and 50 as the total number of colonies on the plate, then 50 × 20 × 500 = 500,000, the total number of organisms.

In collecting samples for bacteriological examination it is necessary to thoroughly mix the milk in the container, whether bottle or can, so as to ensure an even distribution of the organisms. A small amount, 10 cc. is sufficient, is then taken by means of a sterile pipette and transferred to a sterile test tube which is plugged with cotton, properly labelled and taken to the laboratory. If the sample cannot be plated at once it is packed in ice until such examination can be made.

The importance of frequent bacteriological examinations of milk as it comes from the dairies cannot be overestimated; it is the foundation of all successful systems of dairy and milk inspection, and ensures the closest cooperation between the bacteriologist and the dairy inspector. Such examinations are not only a guide to the dairy inspector, telling him which dairies should receive his special attention, but also acts as an indicator of the efficiency of his work. The bacterial count is an inspector of inspectors.

While a high count indicates dirty methods and a neglect of some part of the routine work of production, it does not point out just what particular step was neglected, and therefore responsible for the large number of organisms present. It may be that a number of conditions were responsible for the high count, but one or many they can, as a rule, be ascertained from the Milk Inspector's report on the particular dairy in question. Such a report should contain in full all particulars pertaining to the sanitary conditions of each and every dairy under his supervision.

Milk having a low bacterial content can be produced here as elsewhere; all that is necessary is strict attention to all the details in its production. Cleanliness must be the watchword of the dairyman; he must see that the flanks and udders of his cows are free from dirt and manure; that his milking utensils are properly and carefully cleaned and then kept in such a way that they will not become contaminated with dirt and dust; that the milkers are clean and do not wash their hands in the first milk drawn from the cows, and last but not least, that the milk is cooled as rapidly and as soon as possible after it has been drawn to a temperature low enough—50° F.—to prevent the rapid multiplication of such organisms as may be present. No dairyman can fail in any of the above conditions and secure a low bacterial count in his milk, and while his neglect might pass undetected by the ordinary inspection it can be determined very simply and accurately by a bacteriological examination.

Milk as it comes from the healthy cow is sterile, or nearly so, containing only those organisms which may be present in the milk ducts and sinuses. It receives its contamination from the outside, from the negligence and carelessness of the producer who uses improperly cleaned utensils, milks with dirty hands and allows dirt, dust and manure to fall into the pail. The cleanliness of raw milk is measured more accurately by its bacterial content than in any other way.

During the year 1914, a large number of counts were made from samples of milk taken, in most instances while en route to the consumer. The lowest count obtained was 22,300 organisms per cc., and the highest was 11,400,000. The average for the entire number of counts was 2,300,000 or more than double the standard allowed by the City and County Milk Ordinance, which is a very liberal one, viz., 1,000,000 bacteria in every fifteen drops of milk.

That milk should be produced here in the condition indicated by the bacterial counts is largely due to the absolute lack of efficient milk inspection. The dairymen have therefore fallen back into their old slack methods and now neglect even the simplest and most effective of the steps necessary in the production of clean milk, with the natural result that the commercial milk of Honolulu contains dirt, dust, cow hairs and manure and not infrequently nine or ten million organisms in every fifteen drops, an article not worth the price the consumer has to pay for it. The dirt, dust and hairs may be strained out but not the organisms which they brought with them. They will stay in the milk and multiply until in a surprisingly short time it is rendered unfit for human consumption.

The remedy for these unwarrantable conditions lies in the promulgation of a milk ordinance having in view the conditions to be met with in this territory; an efficient milk inspection service, and the closest cooperation between the different sanitary boards intersted in the production of clean milk.

THE CONTROL OF BOVINE TUBERCULOSIS.

The complete suppression and eradication of bovine tuberculosis has been the main object of the Division of Animal Industry for the past four to five years. That these efforts are meeting with considerable success may be seen from the table printed on a foregoing page. No better idea of the support this movement has met with of late can be given than the invitation extended to the Territorial Veterinarian by the local Medical Society to prepare for their annual meeting a paper on the relation of bovine tuberculosis to public health. As this paper was published only in a medical pamphlet available to the members of the society, we may perhaps be justified here to reproduce such parts of it as would be of interest to cattle raisers, dairymen and milk producers. Reference should also be had to the appended reports of the Deputy Territorial Veterinarians, all of which have given more or less time to the subject of eradication. In the paper referred to, the writer stated as follows:

"In regard to the susceptibility of children to bovine tuberculosis, it would now seem to be definitely settled that the danger to children from tuberculous milk is very great. Following the Tuberculosis Congress in Washington in 1908, where Prof. Koch against asserted his opposing views, Dr. Park, the director of the laboratories of the board of health, started to work on this subject, and has now demonstrated that in the city of New York upward of three hundred children die every single year from bovine infection—three hundred fatal cases occur each year in the single city of New York. Dr. Park estimates that this number amounts to about 12½ per cent of all the fatal cases of tuberculosis in children, and adds, 'Surely we need no better evidence than that to demand of us the protection of human beings against bovine tuberculosis.'

"Dr. Park has also collected from all parts of the world, and these are very interesting. He says: 'In adults 787 cases have been examined, of which 777 show human infection and 10 show bovine infection. The conclusion is that, so far as we can judge, adults are probably fairly immune to bovine tuberculosis infection. Coming to children from five years of age to sixteen years of age, we have 153 cases, 117 of which were of human and 36 of bovine origin. Coming to children five years old and under, we have 280 cases, 215 of which were human and 65 bovine, coming very close to the figures taken from clinical work in England, from which we get the best information on this subject, namely, that from about 23 to 25 per cent of the fatal cases of tuberculosis in children are due to bovine infection. And these figures do not include the numerous non-fatal cases which produce only more or less permanent and more or less severe deformities of the skeleton—hipjoint disease, psoas abscesses, enlarged glands of the neck, etc. When we come to take these into account it seems fairly evident that 30 per cent of the cases of tuberculous children are due to bovine infection.' Another eminent authority, Dr. Stiles of Edinburgh, has come to the conclusion that clinical evidence from most of these cases of bone and joint tuberculosis were of bovine origin. Being called into consultation once he made a diagnosis of bovine tuberculosis in a child who was too far gone to be helped and died within a few days. The father said the infection could not be bovine as he kept his own cow, and she had been tuberculin tested. The cow was killed and was found to be simply riddled with tuberculosis—a far advanced case, such as frequently fail to react to the test. The father was so impressed that he then and there gave a large sum of money for an investigation, the results of which have just been published, and some of which are interesting enough to be quoted here: 'Seventy cases were examined, these being children most of which have not died. Forty-one of these showed the bovine bacillus, and 23 human; three showed both bovine and human bacilli. Sixty-seven of these cases were children twelve years or under, and three adults between 24 and 30 years. Forty-seven were children five years old or under, and of these 32 were infected with the bovine bacillus and 15 with the human, a percentage of 68.' Dr. Stiles goes on to say: 'When we come to examine the family history of these cows, we find some very impressive facts. In 21 cases there was a family history of tuberculosis. Of these 15 gave human cultures and 6 bovine. That is 71 per cent showed human infection, whereas, in the 52 cases there were no family history of tuberculosis, 9 proved to be human and 43 bovine; in other words 83 per cent of these cases were due to bovine infection. The final conclusions to this very valuable contribution to our knowledge of the importance of the bovine tuberculosis infection to children, are to the effect that nobody can deny the great danger to human health from bovine tuberculosis.' 'It is a black spot on the reputation of our civilization at the present time, to permit this disease to continue to reap a harvest of over one million deaths every single year. In the United States alone over 200,000 of our fellow citizens every year go down to their graves from a preventable disease.'

"Up to the present time the efforts of the Board of Agriculture and Forestry to do its share in fighting the Great White Plague by suppressing the *one source of infantile tubercular infection that we know can be suppressed, viz., the milk-borne infection*—has met with but scant support from the municipal authorities of this county and none at all from the other counties, while the Territorial Board of Health has been doing good work all over the Territory, fighting the spread of the disease among all classes and nationalities of the population.

"Whether the efforts of the Board of Agriculture and Forestry along these lines are of any actual value in saving human lives has frequently been disputed, but knowing as we do that children under five years of age are especially susceptible to the bovine tubercular infection, so often contained in milk from tubercular herds, the Territorial Board of Health was asked for statistics in regard to the mortality among children from tuberculosis, in Honolulu as compared to the rest of the Territory for the period of the last three years. The report received covers the number of cases, with the number of deaths, of all forms of tuberculosis among children under five years of age, in the entire Territory and in the District of Honolulu alone, and seems to show that there has been a decrease in the number of cases in Honolulu since 1910, of more than 66 per cent, or, to one-third of the usual number of cases, while the number of deaths seems to have decreased more than 75 per cent, or, to one-fourth of the former number. On the other hand, the number of cases for the entire Territory shows an increase of 40 per cent, and the mortality an increase of 80 per cent per annum. These figures cover the period from April, 1910, to June, 1913, with a total of 102 cases of infantile tuberculosis with 90 deaths, of which number 50 cases with 35 deaths occurred in Honolulu. But whereas the last year ending June 30, 1913, gave the entire Territory 36 cases with 32 deaths, the District of Honolulu had only 9 cases with 5 deaths, which warrants the conclusion that some extraordinary factor must have contributed to this great reduction in the local prevalence of the disease which it would not seem far-fetched to attribute, at least in part, to the absence of the specific infection, the tubercle bacillus, from the local milk supply, especially as milk forms such an important part of the food of children under five years of age.

"'If the public were thoroughly informed of the dangers, among which tuberculosis is only one of many to which it is exposed through the use of impure, dirty and infected milk, the demand for milk of approved purity would rise to the magnitude of a concerted national movement and would sweep all objections and difficulties out of its way.' And in discussing "The Unsuspected but Dangerous Tuberculous Cow," he says: 'There is an important moral side to the milk question which must not be ignored. We may have a right—a very doubtful right, to be exact—to neglect the dangers to which we, as adults capable of judgment and acting for ourselves, are exposed; but we have absolutely no right to neglect the conditions that cause suffering and death among children. The failure to act, and act quickly and unceasingly, until a safe milk, for children at least, is within easy reach of every mother, may be characterized as barbarous, if not criminal, indifference. It is an offense against the innocent, unquestioning confidence which children repose in their adult parents.'

"In regard to the dissemination of infection by tuberculous animals there are a few points to which I want to call your attention. Cattle do not expectorate, and unless the pulmonary excreta are forcibly ejected by a paroxysmal cough they are swallowed. Tubercle bacilli swallowed by cattle are to a great extent passed entirely through the digestive tract and out with the feces without loss of infectiousness. Feces are therefore the most dangerous factor in the dissemination of tubercle bacilli by tuberculous cattle. In this respect feces must be regarded as having a place with cattle similar to that commonly accorded to sputa with tuberculous persons. Cattle that have reacted to the tuberculin test but otherwise show no symptoms of tuberculosis frequently pass tubercle bacilli in enormous numbers with the feces. On the other hand the mammary glands rarely become affected with tuberculosis, and when tubercle bacilli are found in the milk they are generally due to contamination with feces or some other material that contains tubercle bacilli from the outside of the cows or from their surroundings. The frequency of tubercle bacilli in milk and other dairy products is therefore not to be wondered at, and the ease with which the disease is spread from animal to animal, even in open pasture, is easily explained, the infected manure being trampled, and when dry, ground into dust, and scattered by the wind. The importance of strict sanitation in order to prevent the contamination of the milk when even a single tuberculous animal remains on the premises becomes evident. Though adults are known to be fairly immune to the bovine infection the danger of children becoming infected directly from contaminated dirt or dust is not excluded, though milk from an infected stable is the most common means. In the Medical Record for October 3rd this year, there appears a translation from the Berliner Klinische Wochenschrift entitled "Severe, Fatal Infection of Mankind with Bovine Tuberculosis," and as it is of considerable interest in connection with the above, I shall quote it here, even though numerous other more worthy though less recent cases might be added or substituted:

"Beitzke relates the following case: 'A boy aged fourteen, began to lose his appetite, then to vomit. He lost flesh as a result and a cough set in. Pain beneath the diaphragm had been present from the start. The case proved a puzzle to a number of practitioners. Admitted to a hospital with diagnosis of severe anemia, both liver and spleen were found enlarged. To the right and behind was heard a pleuritic friction sound. Red blood cells 5,660,000, white blood cells 8,439. Temperature 38° C. Patient lived six weeks after admission, dying of progressive exhaustion. Edema and ascites developed before death. A brief summary of the case after study of autopsy finds it as follows: Boy of fourteen, ill in all six months, dead of progressive marasmus. Generalized tuberculosis of an unusual and severe type. The amount of caseation in the enlarged lymph glands and spleen exceeded anything ever seen by the author. Both lungs contained uniformly distributed large and round caseous foci—an unusual find. The process had evidently begun in the mesenteric glands, with secondary involvment of the mediastinal and supraclavicular glands, speaking unqualifiedly for an abdominal infection. Bacteriological studies showed undoubted bovine tuberculosis, inoculation experiments giving positive results. The boy had played daily in the cow stable, and had drunk raw cow's milk. The ancestry was sound and the boy himself was healthy. His exposure to the cows had been prolonged, lasting over months. It does not appear that the milk he drank could be traced to any particular infected cows, for nothing of this character is adduced.

"To attempt to eradicate human tuberculosis while children are being fed milk from tuberculous cows is futile. Consequently the first step must be the eradication of bovine tuberculosis and that can only be accomplished by teaching the parents the danger of tuberculous milk. Pasteurization cannot be relied on, especially not home pasteurization. To protect the children the parents must therefore refuse to buy milk from any but tuberculin tested cows, guaranteed officially to be free from the disease. The first dairyman in Honolulu to receive a clean bill of health from the Board of Agriculture and Forestry found the demand for his milk doubled within one month, even though he advanced the price from 10 cents to 12½ cents per quart. There are at the present time few families left where tuberculosis has not claimed one or more victims, and no mother will, after once being taught the danger, willingly buy milk from untested or diseased cows if wholesome milk can at all be obtained for her children.

"There is consequently no reason why any individual or any community should wait for official action in order to get clean milk. In every district or community there is at least one dairyman who has a clean herd, or who is progressive enough to clean up his herd the moment there is any agitation for clean milk, and it may safely be said that an application from a dairyman to have his herd tested and cleaned up, addressed to the proper local authorities, would hardly be denied at the present time. If it should be denied, there is still the practicing veterinarian, who, if he is at all progressive, is the one who should take the initiative in every district or community where the authorities are slow about attacking the problem.

"Bovine tuberculosis must go first, but to await its eradication through the promulgation of laws, ordinances and regulations which necessarily must carry large appropriations to become effective is futile. Action must come from below and not from above. It therefore rests with either the consumer, the milk producer or the local veterinarian to start the ball rolling, and, as it is the milk consumer who is to reap the greatest benefit from the improvement it is only reasonable that the consumer should pay for it. And what would the cost amount to? An advance of one cent per quart of milk would in one year pay the full value of every tuberculous cow in the United States, and besides leave a handsome profit for the producer as well as pay for the work of the veterinarian. In accordance with statistics furnished by the Hygienic Laboratory (Bull. No. 56) of the U. S. Public Health and Marine Hospital Service there were consumed in the United States in the year 1900 (12th census) no less than 740,000,000 gallons of milk and cream by the urban and suburban population alone—that is, this enormous quantity was sold by the milk producers and did not include what was consumed on the farm and what was used in the manufacture of butter, cheese, condensed milk, etc. This amounts to about 23 gallons a year for each person. The consumption of milk in Philadelphia during the year 1905 was estimated at 23 gallons for each inhabitant or an average of half a pint per day for each person. The daily consumption of milk in Honolulu aggregates 8,000 quarts, so an advance of one cent per quart would mean $80.00 per day or $29,200 per annum. This sum would, and probably has, fully reimbursed the milk producers in the City and County of Honolulu if taken as a whole, since the bovine tuberculosis work began in 1910, for losses sustained through the destruction of diseased animals, and it has been paid without objection by the milk consumers. It will therefore be seen that if the annual consumption of milk in Honolulu averages 23 gallons or about 100 quarts per head as in Philadelphia, the insurance against tuberculosis infection through cows' milk would, at an advance of one cent per quart, have cost the consumers on an average of one dollar per annum each.

"In conclusion I take the liberty again to ask the physicians present here today that, in case they agree with me that milk is the most important food in the world (as on it rests the welfare of the coming generations and without it 75 per cent of the newly born children would never reach the age of six months) to further the interest of the milk consumers they meet in their practice, and especially those who have infants or children that drink more or less milk, so that they make some little effort to ascertain whether the milk furnished them is all that it should be. Tell them never to buy milk except in sealed bottles and invariably to hold the bottle up and examine the bottom to see if any sediment has gathered there after the bottle has been standing for an hour undisturbed. If any sediment, however slight it may be, should appear the milk should be rejected and no more milk bought from that dairyman. Sediment in a milk bottle is cow manure, pure and simple, and very rarely anything else, and its presence there is inexcusable and denotes the most slovenly methods of milking, handling and delivering the milk. Tell your clients to inquire of their dairyman whether his cows have been tuberculin tested, and if so, how long ago, and when will they be tested again, and has he any reactors or condemned tuberculous cattle on his premises or on adjoining premises. Get your clients to visit the dairy and see for themselves whether it is clean or not, whether the milk room and milking utensils are clean and sweet smelling, and note the location of the manure pile or cesspool, that is of course only when there is no competent milk inspection service in the district. In the City and County of Honolulu there has been no milk inspection worth mentioning for the past twenty-two months, and many of the dairies are in a more or less filthy condition. It is, however, expected that better service will be established with the beginning of next year, when a competent and reliable milk inspctor should be appointed and when it is hoped that some effort will be made to enforce the local milk ordinance which has been slumbering peacefully for a considerable period. Insist on your clients receiving their milk properly cooled and object to its being delivered in the middle of the night unless your clients are willing to get out of bed to put it in the icebox. But under no circumstances allow the milk to stand on the back porch for several hours to be nosed by dogs and cats, and to speedily reach a temperature that will make the milk bacteria increase on the double quick and give you clabber for breakfast and cottage cheese for your morning coffee instead of cream. As soon as the dairyman realizes that he is under observation he will quickly improve his methods and it is only necessary for one or two customers to leave him and take their milk from an officially warranted clean dairy with tested cows and no reactors on the premises when he will decide to conform with the requirements and endeavor to obtain a clean bill of health for his dairy and his animals."

SUMMARY.

Summing up the result of the past two years' work it may be stated:

(1) That inspection and testing of all classes of domestic animals before or upon arrival here, and the enforcement of the various quarantine regulations, have again proved effective in preventing the introduction of any of the many diseases of live stock and other domestic animals so prevalent on the mainland of the United States or in its colonies and other countries.

(2) That glanders among horses and mules, which formerly caused a greater loss than all other diseases of live stock combined, has been practically wiped out, only one doubtful outbreak, affecting two animals, having occurred during the year, as compared to a hundred outbreaks annually a few years ago.

(3) That bovine tuberculosis has been reduced to a minimum among the dairy cattle in the City and County of Honolulu and bovine tuberculous infection removed from the milk supply in that district which work coincides with a reduction of 50% in the mortality among children under five years of age from all forms of tuberculosis, as compared with an increase of 80% in the rest of the Territory where tuberculous cows are still being milked and the milk fed to the children (facts based on Board of Health records).

(4) That the eradication of bovine tuberculosis on the other islands is being pushed as fast as the Deputy Territorial Veterinarians can do it and the local health authorities and the milk producers and consumers will furnish and support it, and finally—

(5) That the live stock industry of the Territory is prospering under the natural and unparalleled favorable conditions and unprecedented freedom from infectious and contagious diseases of animals, results and conditions which have placed the Territory among the leaders in live stock sanitary work and caused a number of States in the Union to emulate or copy the policies, methods and regulations of this Board.

(6) That hog cholera can no longer be considered a menace to the successful raising of swine in sufficient numbers to supply the local demand as effective means of treatment and prevention are now available to all.

Report of the Deputy Territorial Veterinarian for the Hilo District

BY

H. B. ELLIOT, M.R.C.V.S. (Edinburg).

GENERAL OBSERVATIONS.

So far as horse and mule stock are concerned, the progress previously noted in the eradication of infective diseases has been steadily maintained during the period under review, and we have reason for pride in the well-substantiated belief that no other area in any part of the world can show the freedom from this class of disease that is now enjoyed within the shores of this Territory. The continuance of these fortunate conditions in the future is largely a matter of efficient superintendence of live stock importations, although we will always have to bear in mind the possibility that serious problems may arise in respect to those specific diseases which are most difficult of control such as tetanus and cerebro-spinal meningitis in horse stock, and the various internal parasitisms which affect all species of domesticated animals.

The work of inspection at this port has been greatly facilitated by the construction of a convenient and commodious animal quarantine station situated two miles out of Hilo on the Volcano road. The statistics referring to importations of live stock show a very considerable diminution during the period under review. This is chiefly due to the depression in the sugar industry following the recent tariff changes, although the practice of longer ratooning has reduced to some extent the amount of mule work in the canefields. It seems probable, however, that the deplenishment of the stables from natural causes will compel increased importations during the next biennial period.

The principal work of this office during the next two years will be for the benefit of the small agriculturist who depends upon milch cows and hogs for his living. The greater part of this report is occupied by observations in the nature of a preliminary survey of the dairying industries within this official district and an account of the measures already taken towards the eradication of bovine tuberculosis. With the aid of the newer methods of detecting this disease perfected in the campaign upon the island of Oahu it is my opinion that it is a safe prophecy that bovine tuberculosis will be reduced within the next four years to the same basis as equine glanders, that is to say, that this district will be practically free from this disease. The appearance during 1914 of hog cholera upon this island, which it is surmised has been introduced in the inter-island shipments constitutes a grave menace to the hog industry. For the suppression of this disease regulations governing the quarantine and disinfection of infected premises and prohibiting movement of swine from infected areas would seem to be necessary.

In view of the fact that no campaign of eradication against the diseases mentioned can be effective unless the whole island is placed upon the same basis as the territory around Hilo, I feel constrained to recommend that my official district shall be enlarged to include the district of Hamakua, and that the western districts of this island shall receive closer attention than heretofore. Improvements in automobile transportation make much possible that could not have been attempted before, and I think that between this office and the Territorial Veterinarian in Honolulu, it should be possible to handle the whole situation with the present force at our disposal, although it is undoubtedly unfortunate that it has so far been impracticable to maintain another deputy upon this island. The local Board of Health, displaying a spirit of official cooperation which might well be emulated by all governmental agencies, have offered the assistance of their large staff of inspectors in every part of the island for this work, and this aid should prove invaluable in regulation enforcement.

IMPORTATIONS OF LIVE STOCK.

During the period of 1913-14 the following livestock were landed at the port of Hilo:

	1913	1914
Horses	6	13
Mules	6	76
Cattle	42	8
Sheep	42	0
Hogs	11	9
Poultry (crates)	127	40

The diminution in importations of horse and mule stock is very evident when we consider that the average for previous years is about 250 head. No cases of glanders were detected in these shipments. In accordance with our established rule the quarantine period after landing was extended in two instances on account of manifestation of nasal catarrh in individual animals. This rule is closely adhered to because it is very undesirable that imported animals affected with any form of respiratory catarrh or "distemper" shall be allowed to come into contact with our island stock, and it is hoped that these measures will minimize the possibility of the widespread outbreaks of endemic catarrh which have occasionally occurred in the past.

ANIMAL QUARANTINE STATION.

In 1912 a piece of land about 4 acres in area owned by the Territory, but previously under lease to the Waiakea Mill Company, was secured for a site for the proposed animal quarantine station here. No compensation was asked by the company for the relinquishment of their lien upon the property. This site is located two miles from Hilo upon the main road to Puna, and, although rather more remote from shipping terminals than is altogether desirable, was by far the best of those available, and possesses the great advantage of being completely isolated from local livestock.

Plans for the construction of a station capable of accommodating at least 100 head at one time were drawn up. In the suggestions for these plans careful attention was paid to all drawbacks resulting from local climatic conditions, and the paddocks were made large with adequate housing protection for this number of stock. The whole area is enclosed on two sides by original stone walls, and on the others by 4 foot woven wire Page fencing. Within the boundary lines at a distance varying from 20 to 150 feet are placed the detention and isolated padlocks and buildings. The largest of the three main detention paddocks contains an area of 42,000 sq. feet, with a building comprising shed and feed room 120 feet long by 20 feet wide. The smaller paddocks cover 8,000 and 6,000 sq. feet respectively, and are provided with sheds 50 feet by 20 feet. In addition to the detention paddocks there is an isolation paddock fitted with two large, fly-proof box stalls completely separated from the other divisions of the station. Four other box stalls with adjoining exercising paddocks are provided for the accommodation of more valuable stock such as stallions and brood mares. Through convenient designing of gates and central chute, the station is so designed that all the ordinary operations of handling quarantined animals can be performed by one man singlehanded. The water supply is derived from tanks filled from the roofs of the largest buildings, and is sufficient for all purposes under normal conditions. A fairly comfortable cottage consisting of three rooms and a verandah was added to allow the employment of a resident caretaker.

Bids were called for the construction of the premises and fences, and a contract was let which was satisfactorily completed in July, 1913.

Since then a caretaker has been continuously employed and considerable improvement has been effected on the premises. Without other assistance the caretaker has constructed a macadamized road 200 feet long and 16 feet wide from the entrance upon the

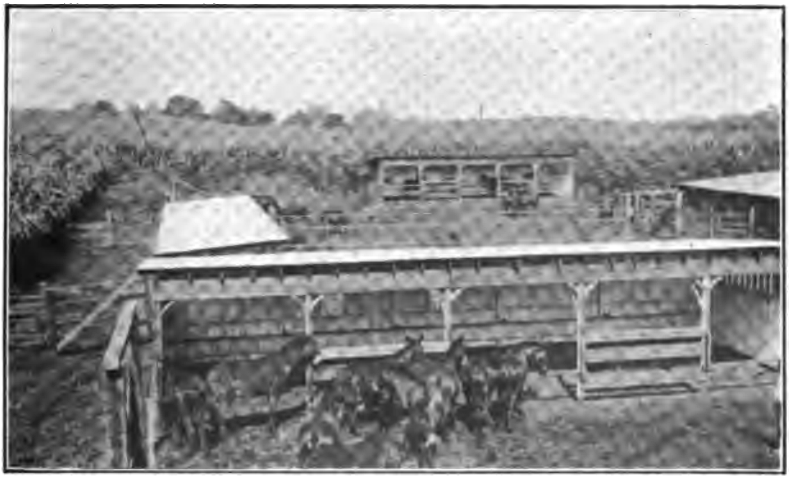


Plate 21. **Parts of new Hilo Animal Quarantine Station, showing construction and isolated position.**

government road to the station, levelled the irregular surfaces in the principal passage ways to a more uniform grade, built 3 foot sidewalks along the same, and filled the floors of the sheds, raising them an average of 6 inches with rock and gravel, so they are now high and dry above the ground level. Several hundred ornamental and fruit trees and many flowering vines have been planted in various parts of the grounds. At other times, when there were no quarantined animals in the station I have had him assist me in dairy inspection work and tuberculin testing.

The Director of the Glenwood Experiment Station has offered to allow their imported Guernsey bull to stand at the quarantine station for a period of two or three months for the benefit of local dairymen. The small fee usually charged for the service of this animal will be sufficient to cover all expenses, and, with the approval of the Board, I hope to accept this offer.

THE HAWAII COUNTY FAIR.

The institution of the first county fair in this Territory is a notable event, which deserves mention in these pages. The original suggestion was conveyed to the Board of Trade of Hilo in a letter from Mr. F. G. Clowes of the Glenwood Experiment Station. The Board of Trade approved the proposals thus made, and a committee was appointed to confer with other organizations interested in the matter. At this conference the administrative organizaion was created by the appointment of an executive committee, and the the date for the fair was fixed. The writer had the pleasure of serving upon this committee in charge of the livestock session.

Although this committee were breaking new ground without previous experience of their own to guide them, the details of the fair were very successfully planned, and the few mistakes that occurred were of a nature that can easily be remedied in future years. For the benefit of others, in this or other countries, who may desire to follow in their footsteps, it may be said briefly that the work of organization should be conducted by numerous small committees enlisting the interest of as many people as possible, that the scope should cover as far as possible everything that is made or grown by local people, that careful attention should be paid to classification of products, that prizes should be numerous but not of great individual value, and that good business management and effective advertising are essentials to success.

In the organization of the Hawaii County Fair the exhibition sections were arranged as follows:

Section A—General Farm Products.
Section B—Useful and Ornamental Plants.
Section C—Government School Handicraft.

Section D—Home Industries.
Section E—Manufactured Products.
Section F—Agricultural Implements.
Section G—Poultry.
Section H—Livestock.
Section I—Baby Show.
Section J—Photographs.

In addition to the competitive sections there were well-prepared and instructive exhibits by governmental agencies such as the Board of Health and College of Hawaii, and by local commercial firms.

The fair was held in the Hilo Armory on November 26-27, and the number, variety and quality of exhibits in most of the sections was a revelation of local possibilities that opened the eyes of the visitors. The livestock section, which was judged by Dr. V. A. Norgaard and Mr. F. B. Clark, was severely handicapped by the fact that whilst there are many splendid high grade and thoroughbred animals of all kinds upon this island they are located upon remote ranches and their transportation would involve some risk and considerable expense. The exhibits were confined principally to dairy classes of milch stock, and although a few good imported animals were shown it was very evident that our native stock are in much need of systematic improvement.

Unfortunately the two days upon which the fair was held were marred by heavy rainstorms, which prevented the attendance of many people from the country districts. In spite of this the financial statement showed a comfortable surplus after the payment of all expenses.

Already plans are being made for a much larger fair during the coming year, and it is believed that this annual institution will be a permanent feature in the life of this island. The outlet for self-expression afforded by these exhibitions, the knowledge gained of local resources, and the opportunity for comparison of results obtained should prove of inestimable value to our people, and there would not seem to be any reason why all of the counties should not follow the good example set by the island of Hawaii.

CONTAGIOUS AND INFECTIOUS DISEASES.

GENERAL STATISTICS.

Disease	No. of owners	No. of animals	Remarks.
Glanders	1	2	
Cerebro-Spinal Meningitis	3	10	
Tetanus	5	8	
Bovine Tuberculosis	24	77	
Endemic Catarrhal Fever	..	..	Scattering cases, no outbreaks.
Hog Cholera	?	?	Data unreliable.

GLANDERS.

In 1913 one case of glanders was detected in a plantation stable in the South Hilo district. This was the first case seen here since the beginning of 1909, and the origin of the outbreak is unknown, although it is possible that the active measures taken in the suppression of the Waipio Valley outbreak by the Territorial Veterinarian may have resulted in the dispersal of a few horses from that neighborhood. After the lapse of a short time suspicious symptoms were noted in the team mate and stable companion of the first animal affected, and a subacute form of the disease with profuse nasal discharge and cutaneous lesions rapidly developed. By adoption of the usual precautions and frequent inspection of all in-contact animals any further spread of the disease was avoided.

Under continuance of the present methods of control it can be safely said that the danger from glanders infection is exceedingly small, and that the time will shortly arrive when it will be possible to say with certainty that the disease has been completely eradicated in this Territory.

EPIZOOTIC CEREBRO-SPINAL MENINGITIS.

Every year we have to record a few cases of this mysterious disease. It is remarkable that no matter how many animals may be exposed in the places affected the number of cases rarely amounts to more than three or four at one time. Most of the cases noted are in the dry districts, and only two serious outbreaks have been seen in the Hilo and Puna districts.

TETANUS.

The number of cases of tetanus seen was less than in the previous biennial period. They were sufficient, however, to suggest the possibility that, in this apparently favorable environment, the disease may become increasingly troublesome in future years.

In my opinion the only treatment of any value is the specific anti-toxin, the price of which, however, is prohibitive except in the case of animals worth more than $150, and then only through the administration of very large doses in the early stages of the disease. An initial dose of twenty to thirty thousand units, followed by two injections of ten thousand units at 8 hour intervals, seems more effective than a number of smaller doses at longer intervals of time, and is all the treatment that is necessary. In the later stages the effect of anti-toxin is very uncertain, and as a rule simply adds an extra burden of expense upon the owner.

ENDEMIC CATARRHAL FEVER.

The past biennial period has been unusually free from the various types of disease included in previous reports under this heading. There are no outbreaks to record, and the few cases noted have been of a sporadic nature scattered in a number of stables.

BOVINE TUBERCULOSIS.

Details and statistics of the work done in the eradication of this disease will be found in the latter part of this report under observations upon the dairy industries of East Hawaii.

HOG CHOLERA.

The appearance of hog cholera upon this island constitutes a formidable menace to the future profitableness of the hog industry. It is impossible to say how, when or where the disease found introduction, but it is surmised that it was first brought into the Puna district in inter-island shipments. The local hog owner usually operates upon a small scale, and when afflicted with a sudden visitation which swiftly empties his pens, he does not trouble to notify the proper authorities. In the absence of any reliable data it is impossible, therefore, to make any estimate of the losses caused by the disease. The first cases seen by myself were in swill fed hogs in a piggery close to the town of Hilo. Investigation at the time of reports of losses in this neighborhood were without definite result. During the course of the year, however, other outbreaks occurred in the vicinity of Hilo, at Glenwood, and in the North Hilo district, and it was learned that a heavy mortality had been experienced in the Puna district during the previous year. A disquieting feature of the situation noted by myself is the appearance of the disease in pens on the edge of the forest reserve where the only channel of infection would appear to be through the medium of wild hogs.

Whilst it is possible that in an area where movement of animals is comparatively small a rapidly destructive disease will burn itself out through lack of access to further material to feed itself upon, I do not consider it safe or desirable to rely upon this chance, and, therefore, recommend very strongly that this office shall be placed in a position to undertake a thorough and systematic campaign for the protection of hog owners. To do this, without adding to the assistance of this office and consequent expense, it will be necessary first to enlist the co-operation of the staff of the Board of Health upon this island. Their force of inspectors covers the whole habitable area of the island, and I am assured by Chief Sanitary Inspector Bowman that his staff will do all that lies within their power to aid in this work. Proper provision must, also, be made for transportation expense, issuance of bulletins to inspectors and owners, and supplying serum at actual cost. After a careful survey of the conditions I feel convinced that the situation can be adequately controlled by the adoption of the measures outlined here, and that the hog industry can be re-established upon a safe and profitable basis. The measures of control recommended are as follows:

(1) Census of Hog Owners: The first step is to make a census of hog owners and the number of hogs owned by them. At the time of this inquiry the condition of their animals should be noted, and previous abnormal losses reported. This can be conveniently done by the sanitary inspectors in the ordinary course of their duties.

(2) Educative Measures: The location of affected areas being ascertained it should be the duty of the Deputy Territorial Veterinarian to visit them, and advise inspectors and owners as to the nature of the disease, methods of transmission, and prophylactic and remedial measures recommended. Bulletins containing full details covering this disease should be issued to all interested persons.

(3) Control Measures: (a) Notification: After owners have been instructed in the nature of hog cholera compulsory notification of outbreaks should be enforced. Owing to the difficulty of securing long distance notifications this should be made to the local sanitary inspector rather than to this office.

(b) Quarantine: All pens in which the disease is found should be placed in strict quarantine to be maintained until the Deputy Territorial Veterinarian is able to pronounce the premises free from disease.

(c) Disinfection and Disposal of Carcases: Complete disinfection of premises is impracticable, but all pens and places in which hogs are confined should be treated with liquid disinfectants and maintained in a cleanly condition. Carcases of diseased animals should be cremated.

(d) Restrictions of Movement: Regulations should be issued governing all inter-island shipments of swine. Such movement should be absolutely prohibited from the districts of Puna, North and South Hilo, and Hamakua upon the island of Hawaii to any other part of the Territory of Hawaii until further notice.

(e) Treatment of In-Contact Hogs: Upon receipt of notification of an outbreak of hog cholera it should be the duty of the Deputy Territorial Veterinarian to visit the premises at the earliest possible date, enforce the foregoing regulations, and submit all in-contact hogs to injections of hog cholera serum, or hog cholera serum and virus simultaneously.

In respect to the last clause of these recommendations, it may be said that the present price of serum, namely 3½ cents per cubic centimetre, is almost prohibitive particularly when we consider that the State of Tennessee is able to supply this serum at 1½ cents. Sufficient stocks of serum might be carried by this Board and retailed to the owners of hogs at actual cost, as it will even then take much time and labor to re-establish the hog industry upon a safe and profitable basis.

(Since the above was written, the price of officially guaranteed hog cholera serum has come down to 1½ cents per c.c.)

In this connection it may be of interest to insert here the specifications enforced by the local health authorities in the construction of pig pens and swill houses in the area immediately surrounding the town of Hilo. Blue prints covering these specifications can be obtained from the Board of Health, Hilo.

SPECIFICATIONS FOR PIG PEN AND SWILL HOUSE.

PIG PEN.

Pens—Size: each pen inside measurement, 7′ x 7′; height from floor to plate, 10′.

Floor—To be of concrete 4″ thick. Mixture 1 part cement, 2½ parts sand, 4½ parts crushed rock. The space to be occupied by the floor to be properly graded to the depth of 4″ below top of finished floor. Any soft or unsuitable material found in the subgrade to be removed and the space filled with fine broken stone or with cinders, after which the whole surface to be thoroughly compacted by ramming or rolling. Floors to be laid in blocks not to exceed 6′ x 4′. All concrete blocks to be put in alternating spaces, and intermediate blocks shall not be cast until at least six hours have elapsed after finishing the first blocks. The finishing course of cement mortar to be in no place less than ¾″ thick, and to be composed of 1 part cement and 1½ parts rock sand. This must be spread on the base course and floated while the latter is still soft and adhesive and finished with a sand surface.

Walls—Both exterior and division walls to be of concrete 4″ thick, 2′ high, and of same mixture as floor.

Drains—Floor of pens to fall to half round gutters constructed down length of pens, to lead to dirt catcher and cesspool.

Troughs—size 1′ 4″ x 3′ 2″ outside measurement, 4″ walls, to be connected to concrete gutter by galvanized pipe in wall at bottom of trough.

Rails—Pen rails, to be of galvanized iron pipe, top rail 1¼″, other rails, 1″.

Dirt Catcher—To be made of concrete, same mixture as for pens, size 4′ 8″ x 6′ 8″, walls 4″ thick, depth 3′, to have red wood cover.

Roof—Roof to project over pens 2 feet, as a protection against rain.

SWILL HOUSE.

Building—Size 12′ x 12′, 8′ high to plate. A concrete swill container to be constructed down one side of building, 12′ long, 3′ 8″ wide, with walls 3′ 6″ high sides and front, 5′ high at back, divided into three compartments. A fire box for cooking swill to be built in as per plans.

Floor—To be of concrete, 4″ thick and same mixture as for pig pen.

Walls—To be of lumber, except round swill container, to a height of 5′, with 3′ wire screen to plate.

Gutters—Swill containers to have a 1½″ galvd. iron pipe let in at the bottom of front concrete wall, to drain off water after washing out containers, and to be connected to a 6″ half round concrete gutter running along outside of containers and connecting to the 8″ half round concrete gutter, extending through pens to dirt catcher and cesspool.

Ceiling—Building to be ceiled, to ensure it being fly-proof.

DAIRYING INDUSTRIES IN EAST HAWAII.

STATISTICS.

General Remarks: The following statistics are inserted at the beginning of this section in order to afford a comprehensive survey of these industries. They were compiled in the course of work undertaken for the eradication of bovine tuberculosis and show the estimated number of animals classified according to the purposes for which they are used, the number of owners of animals tested, number of animals owned by them, the number of animals tested, number of reactors, and the number of animals exposed to infection. *These figures must be accepted as only approximately correct,* and the possibilities of error are indicated in the notes to the figures for each district.

PUNA DISTRICT.

Butter dairies, estimated number of cattle	324
Milk dairies, estimated number of cattle	38
Miscellaneous unclassified	160
Total	522
No. of cattle tested in Series "A"	277

Classification of herds by number of animals.	No. of Owners.	Total no. of Cattle	No. of Cattle Tested.	No. of Reactors	No. of Cattle Exposed to Infection.
Over 50 head	1	100	8	0	0
40—50 head	2	82	82	1	39
20—30 head	3	68	68	0	0
10—20 head	5	72	72	1	16
5—10 head	5	31	31	3	10
3— 5 head	4	13	13	1	2
Less than 3 head	2	3	3	0	0
Totals	23	369	277	6	67

Percentage of reactors 2.1

Notes: The survey of this district includes Pahoa and the whole of the area from 9 to 29 miles on the Volcano Road. The figures comprise animals over 6 months of age, and are believed to be very nearly correct. Among the unclassified are many beef animals, but it is not possible to make any distinction as they are not housed but run wild in forest pastures.

HILO TOWN AND VICINITY.

Butter dairies, estimated number of cattle	27
Milk dairies, estimated number of cattle	579
Miscellaneous, unclassified	60
Total	666
No. of cattle tested in Series "A"	449

Classification of herds by number of animals.	No. of Owners.	Total no. of Cattle	No. of Cattle Tested.	No. of Reactors	No. of Cattle Exposed to Infection.
Over 50 head	2	155	75	32	123
30—40 head	2	78	78	12	27
20—30 head	2	53	53	6	47
10—20 head	4	64	64	3	8
5—10 head	9	57	57	8	18
3— 5 head	11	34	34	1	2
Less than 3 head	69	88	88	5	0
Totals	99	529	449	67	225

Percentage of reactors 14.9

Notes: This survey includes Wainaku, Amaaulu, Kaiwiki, Piihonua, Kaumana, Pohakanui, and Hilo town, and comprises animals over 6 months of age. Not tested so far are a few scattered cattle in Wainaku, and unclassified animals running loose at Kaiwiki and Kaumana.

SOUTH HILO DISTRICT.

Milk dairies, estimated number of cattle 200
Number of animals tested in Series "A" 143

Classification of herds by number of animals.	No. of Owners.	Total no. of Cattle	No. of Cattle Tested.	No. of Reactors	No. of Cattle Exposed to Infection.
10—20 head	4	33	33	1	11
5—10 head	1	7	7	0	0
3— 5 head	6	19	19	0	0
Less than 3 head	66	84	84	0	0
Totals	77	143	143	1	11

Percentage of reactors 0.1

Notes: The survey of this district includes the area between Honolii and Hakalau, and comprises all cattle over 6 months of age.

NORTH HILO DISTRICT.

Milk dairies, estimated number of cattle*........................ 230
Miscellaneous unclassified 200

Total 430

No. of animals tested in Series "A" 172

Classification of herds by number of animals.	No. of Owners.	Total no. of Cattle	No. of Cattle Tested.	No. of Reactors	No. of Cattle Exposed to Infection.
Over 50 head	2	157	60	0	157
10—20 head	2	25	25	1	100
5—10 head	6	32	32	1	
3— 5 head	5	17	17	1	2
Less than 3 head	24	38	38	0	0
Totals	39	269	172	3	259

Percentage of reactors 1.7

Notes: The figures for this district, apart from those relating to actual tests, are based largely on surmise. Apparent discrepancies in the number of animals exposed to infection are due (1) to the fact that animals sold from one large untested herd have been found to be the only animals infected in otherwise clean herds and (2) because 157 of the animals tested were running in the same pastures. Test figures include the area from Hakalau gulch to Papaaloa, and comprise animals over 12 months of age.

KAU AND HAMAKUA DISTRICTS.

The survey and test of animals in the Kau district has been delayed owing to the unexpected amount of work in other districts. It will be undertaken at an early date. The Hamakua district does not come within this official district, but, in order that the work may be completed with systematic thoroughness, I recommend that it shall be so included.

RECAPITULATION BY TOTALS.

Milk dairies, total estimated number of cattle	1,047
Butter dairies, total estimated number of cattle	351
Miscellaneous unclassified	420
Total	1,818
Number of cattle tested in Series "A"	1,041

	Puna	Hilo Town	South Hilo	North Hilo	Totals
Number of owners	23	99	77	39	238
Total number of cattle	369	529	143	269	1,310
Total number tested	277	449	143	172	1,041
Total number reactors	6	67	1	3	77
Number exposed to infection	67	225	11	259	562
Percentage of reactors	2.1	14.9	0.1	1.7	7.3

Notes: To ascertain the average number of cattle in use in milk dairies it is necessary to deduct from the total given above dry cows, heifers, bulls and animals in pasture. It is probable that the actual number of cows milked each day amounts to about 600 in the districts named. In the butter dairies there are about 250 in use per diem. The population of these districts is 30,000 (approximately), and it is doubtful whether at the most, the supply of milk amounts to 1 quart to every ten persons, and, possibly, this is an excessive estimate. Just exactly how children fare under these abnormal conditions can only be determined by very careful investigation, and I do not intend to advance any hypothesis as to the influence of this shortage upon the infant mortality statistics. The vital statistics issued by the Board of Health, however, reveal very clearly that the number of deaths of infants is much larger than might be expected in a favorable climate, and that there is evident need for improved conditions. The figures which are here inserted relate to the County of Hawaii for the two years ending June 30th, 1913.

INFANTILE MORTALITY, COUNTY OF HAWAII, 1912-13.

	Year.	American	British	Chinese	German	Part-Haw.	Hawaiian	Portuguese	Japanese	Porto-Rican	Spanish	Others	Totals
*Births	1912	8	11	58	8	114	169	316	575	112	54	31	1456
	1913	15	13	65	3	100	157	332	578	97	81	55	1496
Deaths under 12 mos.	1912	..	1	7	2	9	55	51	149	17	9	25	352
	1913	1	..	6	..	10	42	48	124	11	8	33	283
Deaths from 1—5 years	1912	2	..	..	1	4	20	27	30	13	6	3	106
	1913	..	..	2	..	4	12	18	27	5	3	4	75

The part-Hawaiian group shows up very favorably in these figures, and it would seem to be possible for the Hawaiians, Japanese, and Portuguese to attain this standard. This would mean a saving of at least one hundred lives annually on this island. Maternal carelessness and insufficient or imperfect nutrition (clean and wholesome milk) are the main causes of this mortality, and the fact that these are removable causes cannot be too strongly emphasized.

COMMERCIAL ASPECTS OF THE DAIRY INDUSTRIES.

Butter Production.

Most of the butter-makers are located in the Upper Olaa region, from fifteen miles on the Volcano Road and up. They have the advantages of a healthy climate, cattle which are remarkably free from tuberculosis, good grass-growing lands, and a large market for their produce. The chief drawback to this region is the heavy rainfall and soggy pastures.

The dairy industry may be said to be still in its infancy. Most of those engaged in it began with very little capital and are now striving to work up into a bigger business. With a properly supported co-operative organization, with more and better animals, and with closer attention to business details they will have a good opportunity to build up a profitable trade. It is very difficult for a few men struggling along in isolated places, more or less remote from one another, to put an industry like this on a really prosperous basis. The history of the butter-making industry in the Central and Western United States is an example of the value of co-operative organization, and shows that such organization, to be successful, must be based upon a sufficient number of animals, and on good business methods.

---

*Birth returns incomplete.

Milk Production

The majority of the milk dairies are situated around Hilo and on the plantations. The average price of milk is 10 cents per quart, and this is probably as much as can be obtained under ordinary circumstances. The business is handicapped by poor methods, lack of capital, inferior quality of cattle and infertile lands. The only advantages that can be placed to the other side of the account is that of comparatively cheap labor and cheap or free pastures. There does not appear to be much inducement for the employment of larger capital or a higher degree of intelligence unless a considerable area of really suitable land was available. Under these circumstances a campaign to improve the standards of milk quality and purity is bound to encounter opposition and the cost of production will necessarily be increased by enforcement of such measures and the question will arise whether the margin of profit is sufficient to meet this increase.

Sanitation of Buildings.

The regulations enforced by the Board of Health in recent years have resulted in very considerable improvement in cowsheds and milk-rooms in the dairies. Concrete floorings in cowsheds and separate milk rooms are now the rule and not the exception. The utensils employed are usually designed for the purpose, and kept in a cleanly manner. The butter dairies, however, have not received the same close attention, and there is much room for improvement along the same lines. It is always going to be a difficult matter to obtain clean and pure milk in these humid districts. Most of the dairies lack both piped water and access to ice, and are usually surrounded by mud right up to the cowshed door. After watching a dozen cows struggle out of a quagmire on to the dairy floor, with legs and udder covered with black mud it is easy to realize the troubles of the dairyman who has a penchant for cleanly methods. To overcome these handicaps in the production of clean pure milk means more time and labor than the ordinary dairyman is able to give, without an added burden of expense, which the consumer is rarely willing to share.

The subject of dairy construction has been carefully studied by the local Board of Health and the plans made by them provide good, sanitary buildings at a reasonable cost to the producer. These plans deserve a wider circulation than heretofore, and through the courtesy of Chief Inspector Mr. D. S. Bowman, from whom the necessary blue prints can be obtained upon request, I have pleasure in inserting the specifications here:

SPECIFICATIONS FOR DAIRY AND MILK ROOM FOR SIX COWS.

DAIRY.

Building—Size: 22′ x 13′6″ divided as follows: Barn 16′ x 13′6″ and Feed Room 6′ x 13′6″. Height from floor to plate 7′. Cross section plan of Barn shows division of width as follows: Full width 13′6″. Outside wall 4″ high—4″, Walk, 2′6″, Gutter 1′4″, Stalls 4′6″, Wall to take sill for stanchions 6″ high—4″, Manger 1′6″, rear wall of Manger 18″ high—6″, Walk 2′2″, and outside wall 4″ high—4″.

Floor. — To be of concrete 6″ thick. Mixture one part cement, 2½ parts sand, 4½ parts crushed rock. The space to be occupied by the floor to be properly graded to the depth of 4″ below top of finished floor. Any soft or unsuitable material found in the sub-grade to be removed and the space filled with fine broken stone or with cinders, after which the whole surface to be thoroughly compacted by ramming or rolling. Floors to be laid in blocks not to exceed 6′ x 4′. All concrete blocks to be put in alternating spaces, and intermediate blocks shall not be cast until at least 6 hours have elapsed after finishing the first blocks. The finishing course of cement mortar to be in no place less than ¾″ thick and to be composed of 1 part cement and 1½ parts rock sand. This must be spread on the base course and floated while the latter is still soft and adhesive and finished with a sand surface.

Walls—A 4″ concrete wall, 4″ high to be constructed round building and a division wall between barn and feed room.

Gutters—A 16″ square gutter to be constructed length of stalls and to have a fall to the 6″ half round gutter leading to cesspool.

Stanchions—Plans call for the installation of the Warriner Stanchion.

Feed Room—To be boarded up and ceiled by 1″ x 6″ G & T lumber, to render feed room rat-proof.

Bars—Barn to be fenced round with 2″ x 4″ bars, with suitable entrance for cattle.

MILK ROOM.

Building—Size: 12′8″ x 10′8″, 10′ high to plate, to be fitted with a double sink, size 7′ x 2′, 10″ deep, one compartment to be used for washing milk cans and the other for rinsing. A scalding tank, set on concrete base, size 4′ x1′8″, for boiling cans after washing, a drain rack 5′6″ x 2′ with two tiers, and a cooling tank of concrete, 4″ walls, size 5′ x 2′ and 2′ deep.

Floor—To be of concrete, 4″ thick and same mixture as floor of Dairy.

Walls—Of concrete, 4″ thick, 4′ high, 1″ x 6″ G & T siding for 4′ and 2′ wire mesh to plate.

Drains—A 6″ half round concrete gutter to be constructed outside dairy to take off water as per plans.

Sunning Rack—To be erected outside room, size 4′ x 8″, to sun milk cans after boiling.

Ceiling—Room to be ceiled by 1″ x 6″ G & T lumber, to render it fly-proof. All woodwork to be painted, inside and outside.

QUALITY OF DAIRY CATTLE.

The majority of dairy animals show a distinct strain of Jersey or Guernsey blood, and in a large number the characteristics of the former breed are very prominent. Along the coast north of Hilo and in the vicinity of the town there is a growing partiality for Holsteins and several of these bulls are now in use here. It is, perhaps, unfortunate that when the Jersey was becoming firmly established as the prevailing breed this change should have taken place. It might have been better practice, and it would certainly have proved economical, to develop and improve one single breed in these districts. Those who are acquainted with conditions in Great Britain are cognizant of the remarkable manner in which breeds were originally localized, and are able to realize how much this specializing helped in the development of desired characteristics.

The influence of the few good imported Jersey bulls has largely been lost through carelessness. The effort towards improvement has lacked continuity. The result is that whilst there are some good cows, we see more of the inferior type which are only moderate milk producers. The number of bulls in the district worth looking at can be counted on the fingers of one hand, and there is naturally great need for the importation of some first class animals of either the Holstein or Jersey breeds. Such bulls might be provided by the Territorial government, and there is one very good argument why this should be done. These men, mostly in poor circumstances, have made large sacrifices in ridding their dairies of tuberculous animals for the general benefit of the community, without one cent of compensation for their loss. At a moderate estimate this loss amounts to $4000, which has been a heavy tax upon a handicapped industry. For one-fourth of this sum two good animals could be obtained and kept at the quarantine station in Hilo. A small fee for service would pay the cost of feed and labor. This seems the only possible way of grading up the local dairy stock without unnecessary delay, and it certainly is to the best interests of both producer and con-

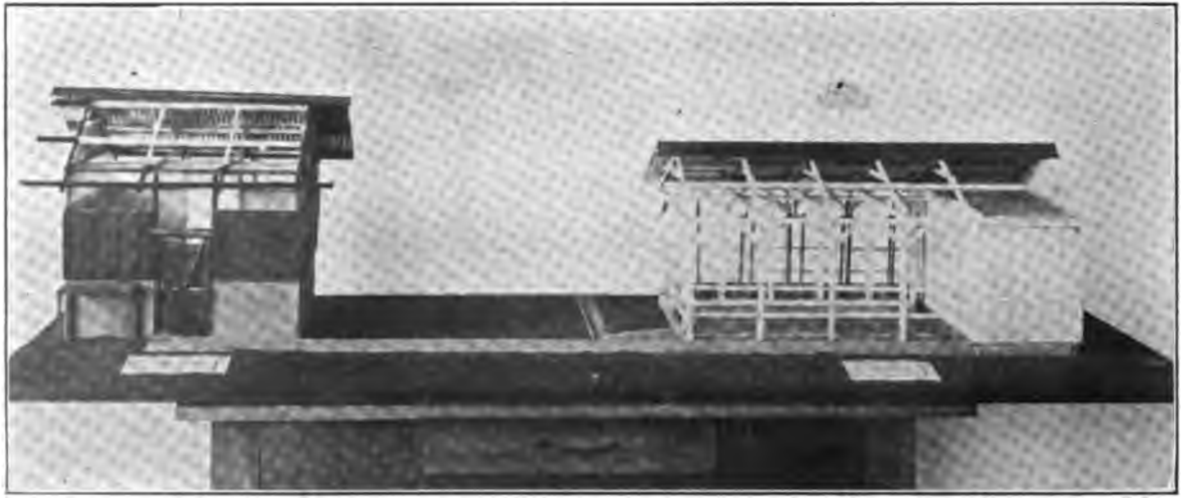


Plate 22. **Model of Dairy Barn and Milk Room.** Exhibited by Hilo Boaru of Health at First Agricultural County Fair in Hawaii. (Total length of model, 3 feet.

sumer that the dairy stables should be filled with profitable animals.

The butter producers are more fortunately placed in this regard than the milk dairies around Hilo. Sometime ago a registered Guernsey bull, Raymond of Alta Vista, champion for three consecutive years in his class at the California State Fair, was imported by the Glenwood Experiment Station and placed at the disposal of the Olaa dairymen for a nominal fee. It is too soon to speak confidently of the results of this experiment, but from the appearance of his progeny in that district this bull is going to prove a very valuable asset. In general it may be said that the quality of the stock in the butter dairies is superior to that found in the milk dairies, and that they contain a higher general average of good animals.

DAIRY LANDS AND FOODSTUFFS.

Any land on the windward side of Hawaii that has sufficient depth of soil will grow plenty of grass, but the farmer's complaint appears to be that it is difficult to get the right kind of grasses securely established. So long as it is only a matter of cultivating grasses for stall feeding, these difficulties will probably be overcome with experience, but it is doubtful whether it will ever be possible to improve established grazing pastures. The land itself is so wet and soggy that the cattle destroy more feed than they consume, and weeds and Hilo grass follow their foot-tracks very quickly. Unless stall feeding is made the rule it is necessary to allow a large area of pasturage for comparatively very few animals.

The lands in Upper Olaa are well covered with deep soil, and it is only a matter of careful experimentation to determine the best methods of treatment to secure good grass crops that can be economically cultivated. When the farmer in this region solves the problem of cheap stall-feeding he will be in position to develop the butter industry on a larger and more profitable scale. The question will then arise as to whether it would not be desirable to house the cattle in large sheds the great part of the time rather than to turn them loose upon the pastures. Cattle do not need much exercise, and in this district their feet and legs suffer from the extremely muddy soils in the open. It would, also, be possible by stall feeding to conserve most of the manure for field application, and the labor cost of handling animals would be reduced.

The milk dairies in the neighborhood of Hilo are much less fortunately situated. The lands at their disposal are very limited in area and consist mainly of those which are too infertile for remunerative cane production and not particularly adapted for any other purpose. This is a decided drawback, although some of the disadvantages are partially overcome by obtaining green forage from plantation lands, the sides of gulches, and other sources. The conditions hardly encourage the owner to make any considerable investment in improving the value of buildings or quality of livestock. All farming enterprises which are not based upon good land are compelled to resort to hand-to-mouth methods and are incapable of real, substantial progress.

The writer has at all times been impressed by the tremendous waste of good livestock feed in the cane-growing districts. Properly worked out methods of conserving canetops in silos would enable almost any plantation to maintain a herd of 200 milch cows without any dimunition in the area of land devoted to cane. A combination of plantations served by railroad transportation would be in a position to establish a central creamery, place it and the associated herds under competent and well-paid management, and develop a profitable industry which would not necessarily have to enter into competition with present producers of milk and butter. Two plantations in this district now maintain herds of more or less nondescript cattle and find profitable use for them in various ways. The market for dairy products in this Territory should be supplied from home sources, and there does not appear to be any reason why this cannot be done. Hawaii is unmistakably an excellent dairy country, and it seems rather unnecessary to expend large sums of money annually in importing dairy produce from other parts of the world. If the Australian farmer can profitably sell butter in London at 24 cents a pound it is evident that our local dairy men have a comfortable margin to work upon.

The local dairyman, however, relies principally upon imported middlings and bran for cattle feed. Alfalfa meal, rice bran and molasses are used to some extent. Although molasses is usually available it does not appear to be regarded with much favor by the milch cow owner. For green forage canetops are used when obtainable, but most reliance is placed upon honohono grass, which grows very abundantly upon all damp soils. Para grass has been introduced extensively and is recommended by Director F. A. Clowes of the Experiment Station as an excellent pasture grass, although less succulent, palatable, and nutritious than honohono, and whilst the aim should be produce all cow feedstuffs locally it seems more than probable that it will always be necessary to depend upon imported rations to some extent.

THE ERADICATION OF BOVINE TUBERCULOSIS

The existence of this disease around Hilo has been proved by tuberculin tests and post mortem examinations made by myself during a period of nearly twenty years. A systematic campaign for its eradication, however, only became possible after the introduction of improved methods of transportation and the use of the simpler and more expeditious tuberculin test as perfected in the work of this division upon the island of Oahu. It was still a matter of some doubt whether such a campaign could be efficiently conducted in the absence of a specific local ordinance or Territorial legislation. But in the interests of both the dairymen and the general public it became evident that a start must be made, and it was finally decided to take up the matter experimentally under the authority vested in this office and that of the Board of Health, and to proceed first with the licensed dairies and those who might voluntarily desire to have their herds tested. The preliminary investigation was conducted without identification tags or markings and comprised over 400 animals in plantation herds and public milk and butter dairies. The anticipated opposition proved to be illusory, and many of the dairy men were found to be anxious to avail themselves of these services, while others fell into line willingly when they learnt that all conditions were imposed impartially and with evident consideration for their interests. The greater part of the work which has been done so far has been performed with the willing co-operation of the dairymen who have cheerfully submitted to the extra labor entailed and the necessary sacrifices incurred, without hope of compensation.

The results of the preliminary test showed clearly that it was necessary to carry out the campaign upon a much larger scale, and with a proper system of identification of clean cows and reactors. It was supposed that the testing could be confined to the public dairies, but as the work progressed it was discovered that the circle was an ever-widening one. It is useless to test the animals in the dairies if the scources of their supply are not subjected to similar investigation. A noteworthy instance of this was encountered in the course of the work. In a dairy of 12 animals only one reacted to the test. Upon inquiry it was learned that this animal had been bought from a certain herd in another district. A month later the same experience was repeated in another dairy, and in this case it was found that the diseased animal had been purchased from the same herd only two weeks previously. The owner of the evidently infected herd owns a large number of animals, how many he cannot say himself, upon mauka pastures on the edge of the forest, and states that *he frequently sells animals for shipment to Honolulu dairies.* We are confronted, therefore, with the peculiar situation that the island of Oahu is protected against mainland infection by strict regulations, but exposed to interisland infection through lack of any restrictive measures whatsoever.* Our experience is that to conduct this campaign successfully it will be necessary to test every animal that can be reasonably classified as a milch cow upon the island of Hawaii, and that this campaign should cover all of the districts in East Hawaii. This will involve much more time, labor, and expense than was anticipated in the beginning, but once done thoroughly it can be maintained in after years with little trouble.

The first systematic test on a comprehensive scale was commenced in October, 1914, and this series, "A", is still proceeding. It is intended to classify the herds upon an interval basis. Class 1, herds containing animals which have all passed two successive tests, will be subjected to further tests at intervals of 12 months. Class 2, herds containing animals which have all passed one test, will be subjected to retest at the end of 6 months. Class 3, herds containing reacting animals, will be subjected to retest at intervals of 3 months. The situation is very clearly revealed in the statistics published in the beginning of this section. Most of the reactors among the 1041 animals tested up to date were found in the dairies around Hilo. The country districts are remarkably free from disease, but there is just sufficient evidence of tubercular infection to compel repeated testing for two or three years to come. The concentration of the disease in one locality, however, affords good reason for hope that the systematic measures now being conducted will result in the complete eradication of tuberculosis by the end of that time.

In the performance of these duties locally we have not suffered any particular inconvenience from the absence of specific legislation, but I am of the opinion that to put the work upon the best possible basis such legislation is necessary In justice to the owners of public dairies such legislation should, in my opinion, enforce compulsory testing of *all* milch cattle, regulate the disposal of reacting animals, and provide sufficient compensation from the public purse for the loss of animals sacrificed for the benefit of the community. The part payment, even, of the value of each animal would be adequate to enlist the hearty co-operation of all owners in this work, and this co-operation will be needed before ultimate success is attained.

MISCELLANEOUS CATTLE DISEASES.

The only infective cattle disease that has been seen locally is tuberculosis, and it is fortunate, also, that the cattle in these districts are comparatively free from diseases due to internal parasites. This exemption is rather remarkable when we consider the serious fluke infestation found in many districts upon the other islands of this group. Until very recently this parasite was not seen in local cattle, but during the past two years a few cases have been discovered on post mortem examination. I consider fluke infestation as serious a danger to cattle as tuberculosis, because parasitic disease are but slightly amenable to measures of control and prevention. As the local climatic conditions appear to favor the life-cycle of the liver fluke, cattle men should avoid so far as possible bringing in animals from fluke-infested districts.

---

*While such shipment may have occurred in past years, it is doubtful whether any dairy man on Oahu at the present time is willing to introduce untested cattle in his clean dairy herd. V. A. N.

The ordinary ailments of cattle common elsewhere are only rarely met with here. Occasionally animals are seen affected with acute digestive trouble or mammitis, but in general the amount of sickness in dairy herds is very small. Even parturition is rarely accompanied with the mischances and incidental diseases encountered in practice in colder climates, and it is most unusual for the services of the veterinary surgeon to be required at such times. So as far as disease is concerned, it may be said that the investment of capital in dairy industries is an exceedingly safe one and that there is little risk of loss from this source.

Report of the Deputy Territorial Veterinarian for the Maui District

BY

J. C. FITZGERALD, M. R. C. V. S. (London).

DISEASES OF LIVE STOCK

GLANDERS.

There is every reason to believe that this disease once so prevalent on Maui, has to all intents and purposes been eradicated. Only one case has been found in the past four years, this in an old animal that was practically pensioned off, and had luckily been kept on the premises of the owner in an out-of-the-way place, not coming in contact with other horse stock. The case was found by the writer in making a tour of inspection of a general character. The animal in question was suffering from glanders in latent form, and it was not until it had been tested with mallein that its slaughter could be warranted. The premises were thoroughly disinfected, the stable (an old shed) burned, and all animals in the vicinity were subjected to the mallein test, the result in every instance being negative. It is to be hoped that this was the last remnant of what a few years ago was the most destructive disease on the Island of Maui.

EPIZOOTIC LYMPHANGITIS.

The only outbreak of this disease which has been encountered within the past few years occurred on the premises of the Wailuku Sugar Company at Waihee. It was first noticed in a mule that had been running in the plantation pasture a few days previous. The animal was isolated for a few days until the symptoms were advanced sufficiently to warrant its destruction. The pasture stock was all inspected, without finding any clue to the origin of the disease, or the source from which it had sprung. The stables, harness, and premises generally were thoroughly disinfected and the animals with which the affected one had been working were quarantined for such a period as would reasonably prove them to be free from the disease.

That only one plantation mule should have become infected speaks well for the natural resistance possessed by animals kept in the prime of condition, which was the case with all of the plantation work animals, and there can be little doubt that had they been covered with open harness galls and raw chain sores, such as was frequently the case a few years ago on this as on many other plantations, the infection would have gained entrance into many another animal system. Not until three weeks after it was believed that the outbreak had been completely suppressed did one more mule show suspicious symptoms. This case proved also to be one of epizootic lymphangitis, a disease in every respect as dangerous as glanders, except that it cannot be transmitted to man, and is non-reacting to the mallein test. It is the same disease which some years ago caused such heavy losses to the H. C. & S. Company and to the Maui Road Board, but which since has been encountered only in scattered and very rare cases in the Islands. It was nevertheless decided to submit the entire Waihee plantation stable to the mallein test, and also to retest the outside animals still running in the rest pasture.

As not a single reaction was obtained, even though the extremely sensitive intra-dermal method was used, it is safe to conclude that the outbreak was suppressed. It was however recommended that the Waihee stables be thoroughly disinfected and whitewashed, and that the top layer of the stalls be removed and replaced with fresh sand. A most thorough disinfection is always required when dealing with this disease, as the specific infection, a fungus of the saccharomyces group, is very tenacious to life and much more persistent than the glanders bacillus. In both instances, however, there seems to be local conditions tending to vitiate their original virulence as the simultaneous decrease in the number of outbreaks of both diseases fully demonstrates.

BOVINE TUBERCULOSIS.

In December, 1912, an ordinance to control the milk supply of this island was submitted to the Board of Supervisors of the County of Maui for their consideration. A special committee was selected by that body to investigate the matter and make recommendations as to what form of ordinance would best suit the needs of the county. This committee met and modified the submitted ordinance to suit local conditions, at the same time suggesting that an appropriation be made to pay the salary of a competent man to act as milk inspector and to assist the Deputy Territorial Veterinarian in tuberculin testing, and other control work. Two years have now passed, and nothing has been done, nor has any attempt been made by the county officials in any way to control the milk supply of the island. It is to be hoped, however, that the work will be considered worthy of recognition and that some action will be taken in the near future whereby a clean and wholesome milk supply may be maintained.

As regards the eradication of tuberculosis from the local dairy herds the work has been continued and extended to the breeding herds on the ranches when so desired by the owners, whose co-operation has been the chief factor in the success so far attained.

During 1913 and 1914 the tuberculin test was applied to 2873 head of dairy and breeding cattle; of this number 63 head were branded and ear-marked as reactors. These animals were later butchered and post mortem examinations made, which in every instance revealed lesions of tuberculosis; only two of these carcasses were rejected as unfit for food purposes owing to their being in an advanced stage of clinical tuberculosis, and emaciated. Eleven head were slaughtered and buried without examination.

In December, 1914, the systematic testing of all the dairy herds on Maui was commenced and will be continued as rapidly as possible. From results so far, there is every indication of an improvement in conditions, as out of a total of 628 head already tested there were only 11 reactors, or 1.7 per cent.

The large breeding herd of Grove Ranch, consisting of pure bred and graded Polled Angus cattle, has been tested regularly for the past three years, and with the facilities provided by the management for fighting tuberculosis, such as isolation pastures for reacting cattle, testing chutes, etc., there is every reason to look for a total eradication of the disease in a few more years. The process of eliminating reactors to tuberculin from a ranch herd is not a costly operation if conducted systematically, thereby getting the majority in the initial stages, and destroying them when the pastures are good and the cattle in condition for the butcher. The method used here for resting the pastures from which tuberculous cattle have been taken, is by grazing horses in them for a few months, these animals being practically immune to the disease.

CEREBRO-SPINAL MENINGITIS.

The outbreaks of this disease have in a majority of instances during the past two years been of a less virulent nature, the disease having occurred chiefly in an endemic form. The only exception was an extensive outbreak on the Island of Molokai to which the writer was called by Mr. George P. Cooke, on whose ranch the outbreak occurred. Some thirty head of horses and mules were affected within a short space of time, the case being ascribed to mouldy alfalfa on which all the affected animals had been fed. Twelve deaths occurred, the remaining animals recovering under treatment. During the year 1914 very few cases have been recorded in comparison with previous years, and in most instances they were apparently of sporadic origin and occurred singly. This may be due to the fact that the climatic conditions have not been favorable to the growth of either fungi or larval parasites, the weather having been generally cold and the rainfall much heavier than in average years.

"STRONGYLUS ARMATUS" IN HORSE STOCK.

A disease of peculiar interest occurred among the horse stock of the Hawaiian Commercial & Sugar Company, during the summer of 1913, causing many fatalities and presenting a set of symptoms heretofore unseen. Its ravages were confined chiefly to mules, affecting them suddenly whilst at work. Many of the affected animals died in harness a few minutes after the first symptoms were presented.

The most striking symptom noticed, whenever opportunity allowed the writer to see the animal previous to death, was that of choking, the animal evincing the greatest difficulty in breathing, which was always accompanied by a roaring sound; the pulse was rapid and congested, and in the advanced stages, the pupil dilated and the animal totally blind, death taking place usually within half an hour from the onset. Hemorrhages from the nostrils were frequently observed in these very acute cases.

In the milder cases the animal would first be noticed breathing with a loud roaring sound whilst at work, but if taken out of the harness immediately, the symptoms would rapidly abate, and the animal in a short while would be able to walk off to the stable, the gait usually being a little staggering. Some of these milder cases will recover under treatment, but the process is slow, requiring sometimes months, and if trotted or given any form of exertion during convalescence the roaring breathing will be resumed and a relapse occur. Post mortem examination usually shows congestion of the meninges hyperemia of the lungs, the intestinal tract and especially the stomach exhibits acute indigestion. The blood is fluid and tarry, suggesting death to be the result of asphyxiation, due possibly to paralysis of the respiratory center. Many brains have been examined sectionally to support this theory of cerebral infarct of parasitic nature, but the results were in no case corroborative. The mesenteric arteries in nearly every case are found to contain emboli, formed by the strongylus armatus larvae, which occlude the blood flow to a greater or less extent.

This outbreak continuing with such serious result and being of such a perplexing character; the Territorial Veterinarian visited Maui at the request of the writer, with a view of ascertaining its cause. Many animals were inspected and post mortem examinations made, the results of which suggested in his opinion that the disease was due to the effects of the strongylus armatus, and more rarely to a toxemia produced by mouldy feed, as described in his earlier reports.

There is little doubt that when more is known of the life history of the "Strongylus Armatus" it will prove to be one of the biggest factors in equine diseases in tropical countries; the great majority of fatal colics are undoubtedly due to thrombi in the anterior mesenteric artery, consequent upon the invasion of this parasite; from recent investigations made, the writer has found that over sixty per cent of the horse stock on Maui may safely be estimated as suffering from this condition; this conclusion has been drawn from post mortem examinations made on all that have died, whatsoever the cause of death.

Inasmuch as the Strongylus Armatus is and has been known to be one of the greatest enemies to horse stock in the Territory, a methodical campaign against this parasite wherever practicable would appear to be a good measure and would probably best be effected by the filtration of the drinking water and by preventing the work animals drinking from the stagnant pools so often found in plantation rest pastures.

CONTAGIOUS PNEUMONIA IN SWINE.

Two outbreaks of contagious pneumonia have been attended, the disease occurring in both instances in range hogs, in the Kula and Makawao districts. The disease in each case appeared to be of sporadic origin, as no history of the affected animals having come into contact with other pigs could be elicited, and as no animals had been brought to the premises from other districts. The sick animals were segregated and the premises quarantined and disinfected. The percentage of deaths was not high and would have been greatly reduced had the animals been tame and more accustomed to confinement. The disease in a majority of cases appeared to be quite amenable to treatment dietitic in nature in accordance with the Federal Bureau of Animal Industry's recommendations.

SAN DIEGO FLEA ON CHICKENS.

A parasite known as the San Diego flea made its appearance on Maui within the last two years, and was just noticed in the Kahului district. This parasite infests the heads and necks of fowls and pigeons, frequently causing sores on the combs of the former, and, in many instances, causing death. Many parasiticides had been tried, but with little result until gasoline was used; this proved magical in its action, removing the fleas almost instantly, and with no ill effect on the bird. The process is simple and easy of operation. The bird is held by the legs by one hand, and with the other hand the eyes and nostrils are closed. It is then submerged in a bath of gasoline for a few seconds, afterwards being put into a box to dry, from which all the fleas may be collected later.

ANIMAL HUSBANDRY.

The practice of the strictest economy which has been forced on the community at large by the adverse legislation to the sugar industry has to a very great extent militated against the general progress of the live stock industry. Many improvements that would have been made in the interests of agriculture and animal husbandry under other conditions have of necessity had to be relinquished. Nevertheless, the improvements that have been made show much foresightedness and tenacity of purpose, as not only were they necessary, but in the majority of instances, proved that their adoption made the practice of further economy possible.

The importations of live stock have been few and far between, but those that have been made have consisted principally of breeding stock of good quality, mostly pedigreed animals, including prize winners. A noteworthy example of this is shown in the illustration of the six Polled Angus bulls imported recently by Mr. W. A. Clark, manager of Grove Ranch. These animals are all blue ribbon winners in mainland shows. A number of high class boars have also been imported, which, with many crates of various breeds of poultry, will help the agriculturists to get the most out of their homestead acres. Of other improvements that may be of interest to stock owners generally is a new stock feed consisting principally of algaroba bean meal. This bean, which grows extensively in the sandy localities of central Maui, has but recently received the attention it deserves as a feed crop. Heretofore a large percentage of the beans were wasted, the undergrowth in the thickets being so heavy that it was impossible for the cattle to get at the fallen beans. Now the trees are pruned of their lower branches and much thinned out so that cattle have easy access to the fallen beans. This also permits grass to grow in the open places and allows of the beans being collected in seasons of plenty and stored until converted into a meal of excellent quality which is rapidly substituting the more expensive barley; this meal, unlike similar products heretofore manufactured, is not sticky, but is a fine, dry, powdery meal, in which all the seeds are thoroughly ground. It is therefore easily mixed with other food materials, for instance, molasses, rolled barley and bagasse. This ration is very satisfactory, besides being considerably cheaper, and keeps almost indefinitely if properly warehoused. As a ration for brood mares and colts in combination with bran it should also prove of great value. Another product manufactured by a similar process is alfalfa meal, made from alfalfa now grown extensively on the Hawaiian Commercial & Sugar Company's ranch, where it is rapidly taking the place of the expensive imported feeds hitherto used.

STABLES.

Many minor improvements have been made in the stables of the various plantations for the comfort and welfare of the working stock. Electric clipping and brushing machines have been stalled and the manufacture of harness has become a plantation industry which not only has proven a big economy, but which also insures each animal being provided with a set of harness that fits, and in which it can work comfortably. Sore shoulders and harness chafes, so common in years gone by, are no longer tolerated, each hospital day from such cause being considered an inexcusable and avoidable loss.

VETERINARY HOSPITALS.

Many improvements have been made in the various plantation veterinary hospitals both in their capacity and equipment. In a single one of these, during the past year 223 serious cases were treated, 191 of which were discharged as cured. Many of these cases would have been destroyed outright or permanently incapacitated had these modern facilities for proper treatment not been provided.

DAIRIES.

A thoroughly up-to-date dairy building has been erected on the Hawaiian Commercial and Sugar Company's ranch, which embodies all the necessary equipment for the production of clean and wholesome milk. The stable contains sixty stanchions, has concrete floor and drains, and an adequate supply of water (the waste water being used for the irrigation of alfalfa). The milk and wash rooms are fly proof structures with double floors and walls, to which the milk is taken directly and cooled with ice; from the bottling tank it is drawn into sterilized bottles, sealed and distributed without delay. Only tuberculin tested cows are used in this dairy.

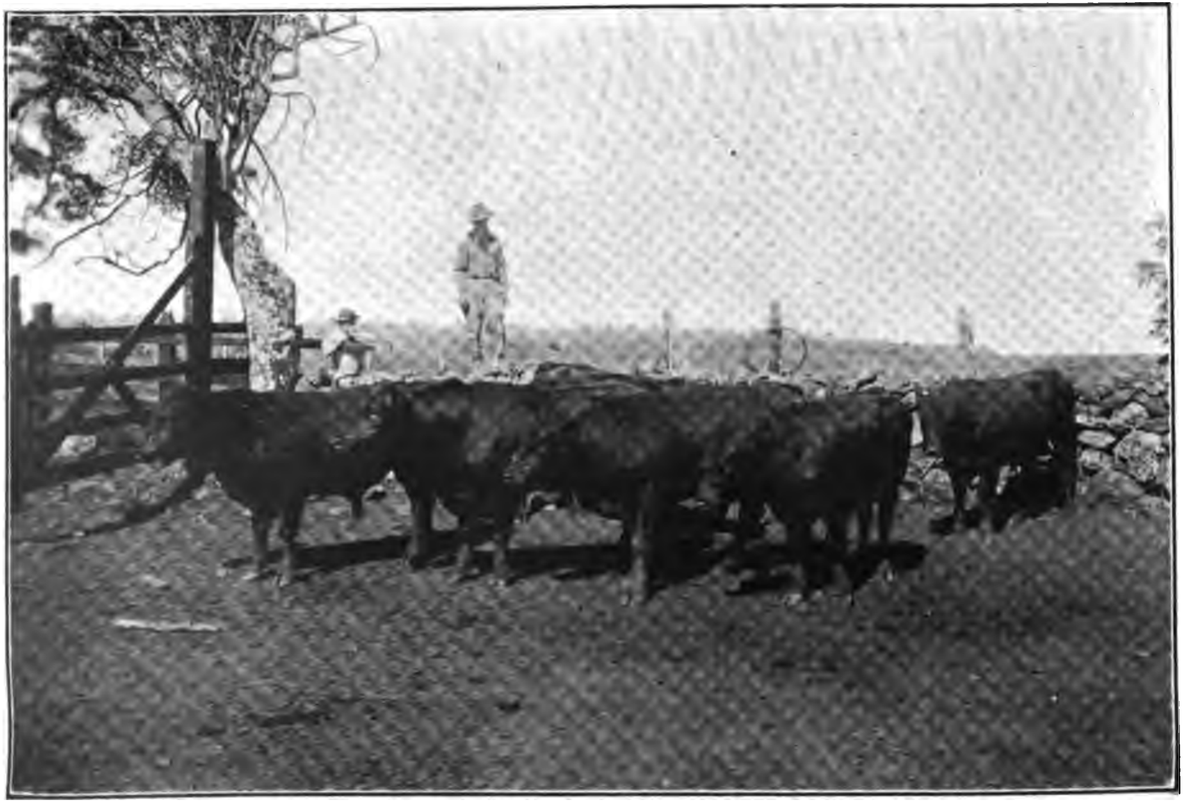


Plate 23. **Six Prizewinning Polled Angus Bulls, two years old. Grove Ranch, Maui.**

Plate 24. **Polled Angus Purebred Cows and Heifers, Grove Ranch, Maui**

QUARANTINE STATION.

The quarantine station for the port of Kahului, mentioned in the last biennial reort, was completed in February, 1913. It is situated on the Kahului-Paia road about half a mile from the Kahului Wharf. The premises cover a little over two acres and consist of two corrals, with sheltered feed racks, two loose boxes suitable for the accommodation of stallions, with feed room and sleeping accommodation for a casual attendant. An isolation box stall, which is fly-proof, stands in its own corral, with a separate water supply.

This station would have been a great convenience to the Maui importers of live stock, but as stated, their number has been small as compared with previous years, and as a result of the almost total disuse the paddocks are rapidly becoming overgrown with algaroba.

HORSE BREEDING.

While no radical changes have been made, progress in this very important industry is noticeable everywhere; however, there is still ample scope for improvement, more especially in the class of draft animals being raised. Too much stress cannot be laid upon the necessity of this Territory becoming self-supporting in horse flesh, particularly draft stock, as there is little doubt that the shortage of horse flesh in the United States, created by the demands of the warring governments for remounts and artillery horses, will be felt in the islands. The abnormal demand created by the tremendous orders from Europe in America can better be judged when cognizance is taken of recent statistics which show that the life of the average horse in aciton is five days; that the cavalry and artillery are proving the most effective branches of the service; and that agents of foreign countries are daily travelling through the horse breeding states purchasing everything available and at all suitable for remounts and artillery purposes. This drain upon a once great industry, already crippled by anti-racing laws is already being deplored by the leading authorities in the horse-breeding world and army world of the United States, who see the gravity of the situation. Under the circumstances it would seem advisable for horse breeders of this Territory to take such steps as will, to some extent at least, enable the industry to supply the draft animals required by the plantations, at the same time assuring themselves of a goodly profit which would otherwise go to the breeders on the mainland. There is no greater stimulus to the horse breeding industry, especially among small owners, than an opportunity to select from a number of high class stallions a sire suited to their mares.

This may be attained in this Territory in one of three ways, namely: by the establishment of a breeding depot of the United States Government; the organization of a horse improvement society, or by the courtesy of breeders and owners of stallions. Live stock and agricultural shows should be held on the various islands periodically so as to give the small breeder an incentive to improve the class of animal which he raises. But before any real improvement can be expected or even hoped for, there are some changes which must be made by the breeder himself. Among these may be mentioned the growing of feed crops and conservation of natural food resources, which will substitute the lack of feed values in the grasses, provide food when droughts deplete the pastures and supply the necessary amount of bone-forming food. Greater attention must be given to the pastures themselves, giving them credit for the animals they raise and ferilizing and fortifying them as would be done in the case of agricultural lands; at the same time banishing the idea that a pasture is capable of supplying a certain number of beef cattle, and so many colts year after year without any care or fertilization. The argument may be correct numerically, but what class of animal can be expected from a pasture that has everything taken out of it and nothing put in? Again, that time-honored and popular fallacy must be forgotten that a mare can raise a colt of good class if turned out in a pasture where her food supply or lack of it, depends entirely upon the climatic conditions, and whose owner considers that after the mare is bred his troubles are over until such time as he shall go out to bring in the colt and break it. These practices have been responsible for what has been so popularly termed "tropical degeneracy." It must of course be admitted that climatic influences in the tropics are such that there is a tendency to diminution in size and bone. This is illustrated by the native horses of all tropical countries being small boned, wiry animals (as in Arabia and India); but from observations made by the writer on the thoroughbred stud farm of Mr. H. A. Baldwin of Hamakuapoko, as well as with mares of his own, he is of the opinion that climatic conditions play only a small part, and that the lack of a sufficient and properly balanced ration is almost solely responsible for any degeneracy occurring. The last, but by no means the least of the necessary changes to be made by the breeder is the selection of the best mares for breeding purposes and not as in the past only those too old for work or suffering from diseases such as spavins, curbs, ring bones, etc. The thoroughbred stud farm at Hamakuapoko, established by Mr. H. A. Baldwin a few years ago, is a step in the right direction, and consists of a large quadrangular stable surrounding an open court and con-

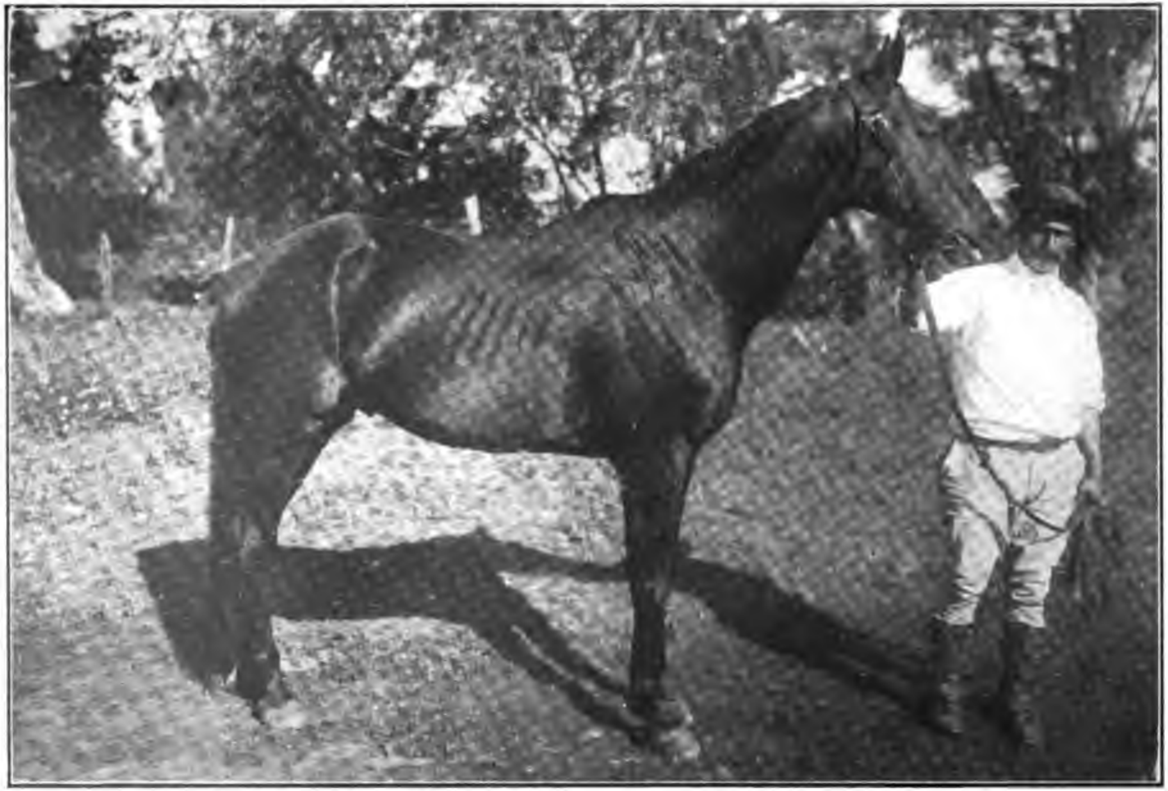


Plate 25. Thoroughbred Stallion "Sileo," by St. Andrew ex Silentia.
(Property of H. A. Baldwin, Maui.)

taining wash boxes, foaling boxes, and detached from the main building stallion boxes with independent exercise yards. There is also a large breeding shed, rooms for attendants and ample storage lofts for feed. This building is surrounded by paddocks of about three acres each, which have sheltered feed racks and running water. The stud farm consists of four brood mares of excellent breeding, and which represent some of the best blood in America and England, and is headed by the superbly-bred horse Sileo, a descendant of the greatest known sire, "St. Simon." The get of this horse are all showing quality, combined with what is needed in this country, namely, "bone." Five young thorough-bred stallions are now in the course of development, and will when matured be stationed on different ranches for service. In addition to the above mentioned mares, Sileo has been bred during the past two seasons to Mr. Baldwin's half-bred mares, and also to a number of approved mares, the property of various owners free of charge. The colts from these matings are a good looking lot, and should be a great adjunct to the horse improvement scheme. This season Sileo will be stationed on the Grove Ranch, while the Hamakuapoko stud farm will use the sire "Harvester," who has been lent through the courtesy of Mr. Charles Lucas, his owner. This animal was bred by Mr. A. B. Spreckels at the Napa Stock Farm, California, and is a full brother to the great horse "Voorhees."

A few illustrations are inserted showing the class of the brood mares and the colts being raised, and indicating the results that eventually may be looked for from this effort in the interests of horse improvement.

Many horse breeders would do well to investigate the feed values of molasses and algaroba beans in localities where they are easily procurable, as both have been used with very good results, and at small cost, as a feed for brood mares and colts on the Island of Maui. The growing of alfalfa and Rhodes grass also deserves their attention, the latter making a hay of rather course quality, but one that can be fed very cheaply and with satisfactory results.

CATTLE BREEDING.

The progress made in this direction is slow but sure. The influence of the blood of bulls imported in recent years is apparent in the herds, and there is a marked improvement in the class of cattle being butchered; this is plainly evident by the market weights, dressing percentages, and earlier maturity of the cattle.

Experiments have been made on the Hawaiian Commercial and Sugar Co.'s ranch in the feeding of cattle for butchering purposes with molasses, using bagasse as a vehicle. This method should prove economical for cattle raisers in all districts where molasses can be procured cheaply. The appended photographs of a herd of black Polled Angus cattle were taken on the Maui Agricultural Company's Grove Ranch, whilst the writer was testing the herd with tuberculin. These animals show the influence of blood imported periodically for a number of years, nearly all the cattle on the ranch now being of uniform color and conformation.

During the past year a number of pure bred Jersey cattle have also been brought to the island and should in time have a marked influence on the local dairy herds, which with the suppression of tuberculosis will benefit public health and welfare to a great extent.

HOG RAISING.

The hog raising industry has of late received a good deal of attention from the stock breeders of Maui. This has to a great extent been stimulated by the advance in the price of pork, together with the knowledge becoming more general that a well-bred pig will develop faster and give better returns from a given amount of food than will a "scrub."

The general class of hog to be seen on the ranches and in the piggeries of the small owner has been much improved during the past few years, and a really good animal is becoming the rule instead of the exception. A few importations of pedigreed animals have been made, including Duroc-Jerseys, Berkshires and while belted Hampshires, the latter consisting of a shipment of two sows and a boar for Dr. W. D. Baldwin, of Haiku; these animals are of excellent quality and of good pedigree. Two consignments of high class Duroc Jersey pigs of equally good quality have been received, one for the Hawaiian Commercial & Sugar Company's ranch, and the other for Mr. Manning of the Haiku Homesteads. Prof. Krauss of Haiku is interesting himself in the breeding of Berkshires, as is also the Maui Agricultural Company's Grove Ranch.

The influence of the quarantine of pigs necessitated by the occurrence of hog cholera on Oahu has been to some extent a handicap to inter-island traffic in hogs, but considering the fact that there has never been a case of this disease on Maui, the hog raisers of the Island can only accept the quarantine as a blessing to the local hog industry.

Plate 26. Three Promising Colts from Maui, property of H. A. Baldwin.
1. "Dutch Parrot," by Deutschland ex Northwest.
2. "Senator B," by Sileo ex Delagoa.
3. "Copra," by Sileo ex Coppit.

Report of the Deputy Territorial Veterinarian for the Kauai District

BY

A. R. GLAISYER, D. V. M.

LIVE STOCK CONDITIONS IN GENERAL.

In tendering a report as Deputy Territorial Veterinarian for Kauai, for the years 1913 and 1914, I am happy to say that with the exception of one outbreak of hog cholera this island has been free from all contagious diseases of an acute character. Glanders has not existed here for years, though a rigid inspection is frequently made of nearly every stable. There is some tuberculosis amongst cattle, but I am convinced, a small amount.

During March and April, 1913, the Board of Supervisors considered the advisability of passing an ordinance for the compulsory testing of cattle for tuberculosis. I worked very hard for this ordinance, which was drawn up following the lines laid down on Oahu. The Board considered that it would be an injustice to compel commercial dairies to test and not private owners, so the ordinance was changed to include all milk cows. On Kauai there is one large dairy of about seventy cows, on the south side of the Island, supplying milk to the public, and two other smaller ones. The rest of the milk supply is in the hands of private owners having one or two cows, mostly Portuguese who work for the plantations and augment their living by selling a bottle or two of milk a day. These are of course technically dairies and pay a license in some cases, and in others not. In addition to this a large number of people are supplied either with milk or with a cow by some of the larger proprietors.

An open meeting of the Board of Supervisors was held to discuss the ordinance, which had first been published in the local paper, and although it was defended by letters from the various physicians, public sentiment was overwhelmingly against it and the ordinance was lost.

In spite of this discouragement I continued to work up sentiment in favor of the test and now most sales of milch cows are made contingent upon the tuberculin test. Two of the above mentioned dairies have had their herds tested during the past year. One had no reactors and the reactors in the remaining one were at once killed. Other tests have been made from Kilauea to Kekaha without a single reactor, all private animals, in herds ranging from one to thirty. I am aware that in point of numbers this work does not show up very well in Kauai, but the conditions here are very different from the other islands and public sentiment is not favorable to the work of eradication.

The fact also that the district extends eighty miles makes it very hard. I hope in a few years to get the public aroused. but it is discouraging. The chief reason, undoubtedly, for the low percentage of reactors is the fact that most milch animals in Kauai are almost all of the time turned out. Numbers of cows are only milked by their owners for a month or six weeks to gentle the calves a little and are then replaced with others.

HOG CHOLERA.

In July, 1913, I was notified by the Koloa Plantation manager that an unusually large number of Japanese had asked permission to bury pigs in a manure pile, and also that a number of pigs belonging to the plantation had died. Upon investigation the cause proved to be hog cholera, though this at first was difficult to establish, as the disease did not run a typical course, but was of a chronic type.

The infection was brought in in May by two pigs from Honolulu belonging to a plantation laborer* From these it spread down the line of pens owned by other laborers and then to other parts of the village of Koloa where Chinamen kept pigs. It had also extended as far as some of the camps five miles from Koloa proper, wherefore the district of Koloa was declared quarantined and three guards stationed night and day at the points where any animals could be taken out. These guards were paid by the County, and did good work turning back many Orientals who were trying to sell their hogs outside when the butchers in Koloa took advantage of the situation and lowered their prices. As this was expensive, after two weeks I hired one man to make a round of the district every day, and keep a record of all hogs, thus effecting the same purpose as the guards. This was kept up for three months.

I also caused to be torn down and burnt up some sixty odd unsanitary pig pens and caused new sanitary ones to be built after thoroughly disinfecting all premises where it was not practicable to build the pens in another location. I also ordered a large quantity of hog cholera serum from Honolulu and injected this according to directions as to weight, in those pens where the owners were willing to pay for it. This, I may say, was in the majority of cases and it worked perfectely, while in pens contiguous to where the serum was not used they caught the disease and died. The custom amongst the Chinese, who are the pork butchers there, is to do their killing about four o'clock Sunday morning, but this I changed to five Saturday evening so that I might inspect all pork offered for sale. Two were condemned as unfit for food.

---

*No record of such a shipment is obtainable from the Inter-Island Steamship Company. V. A. N.

The reason for this change was the distance from Koloa to Lihue; also the inspector in taking his daily census would notify me of anyone who wished to kill a hog for their own use in any of the camps or the town and I inspected them. This quarantine was kept up till October 15th, and then there not having been any cases for a month and nearly all the remaining hogs having been inoculated, it was lifted. Since then there have been no further cases.

There was nothing of particular note to record of the outbreak except that the majority of the animals seemed to have it in a subacute form, some in a chronic, and very few in the acute type. Altogether a little over two hundred head died and I believe that if it had not been for the prompt measures taken it would have spread all over the Island and caused large losses in districts where more hogs are raised than Koloa.

SCLEROSTOMA MISNOMER (SPINAL MENINGITIS).

The losses from this disease have been quite large in number, viz., 22 scattered in various parts of the Island. I have tried all the recommended treatments but have failed to get good results. In many cases after the first attack when the animal is found on the ground struggling to arise, after being slung he appears almost normal, but usually in from six hours to three days the muscles of deglutition become paralyzed and the animal dies from lack of food and water.

In two cases I tried feeding through the nose with a probang, in the hope that enough food in the shape of oatmeal gruel and water might be ingested to keep them alive; but this had no effect, even hastening, I believe, the death of the animal through worry and the bruising and consequent inflammation of the nasal passages. In two cases where an opening was made in the oesophagus and artificial feeding tried the results were the same.

The best plan I have found is to flush the animal at once with a hypodermic injection of arecoline hydrobromide and then give 4 cc. of fluid extract of Nux Vomica three times a day, and an ounce of alcohol every three hours. In those cases where the esophageal muscles were not too much affected and the animal able to ingest a little food these measures seemed of some avail, but as soon as they cannot swallow they should be destroyed to prevent suffering. The only means apparently of combatting this scourge is by prophylaxis and the readiest means in my experience have been to filter all drinking water through a sand and rock filter, and to give once a year or every six months three ounces of turpentine in one-half pint of milk or raw linseed oil.

The regular routine of veterinary work has yielded nothing novel. In 1914 the Kauai Planters' Association allowed me $100.00 to be used as a revolving fund for the purchase of various sera and bacterins. I have found these to be of valuable service in infected wounds, fistulae, etc., but only when used in conjunction with the ordinary treatment.

No particular great studies have been made in breeding for the last two years. The breeding of mules has been demonstrated to be a success at Kekaha plantation, they having a number of fine colts by their imported jack. I have in previous reports touched upon the horses raised by Koloa, Lihue and Kilauea, who are now in a position to supply almost all their work stock, as has been done by the Lihue Ranch for a number of years. Grove Farm has also joined this list by the purchase of some good mares and a Percheron stallion.

There is no doubt that in the near future horses will to a large extent supersede mules.

In conclusion I would say that the health of the live stock for the last two years has been good and that public attention is being directed to the undoubted benefits to be derived from the compulsory testing of all sources of supply of milk.